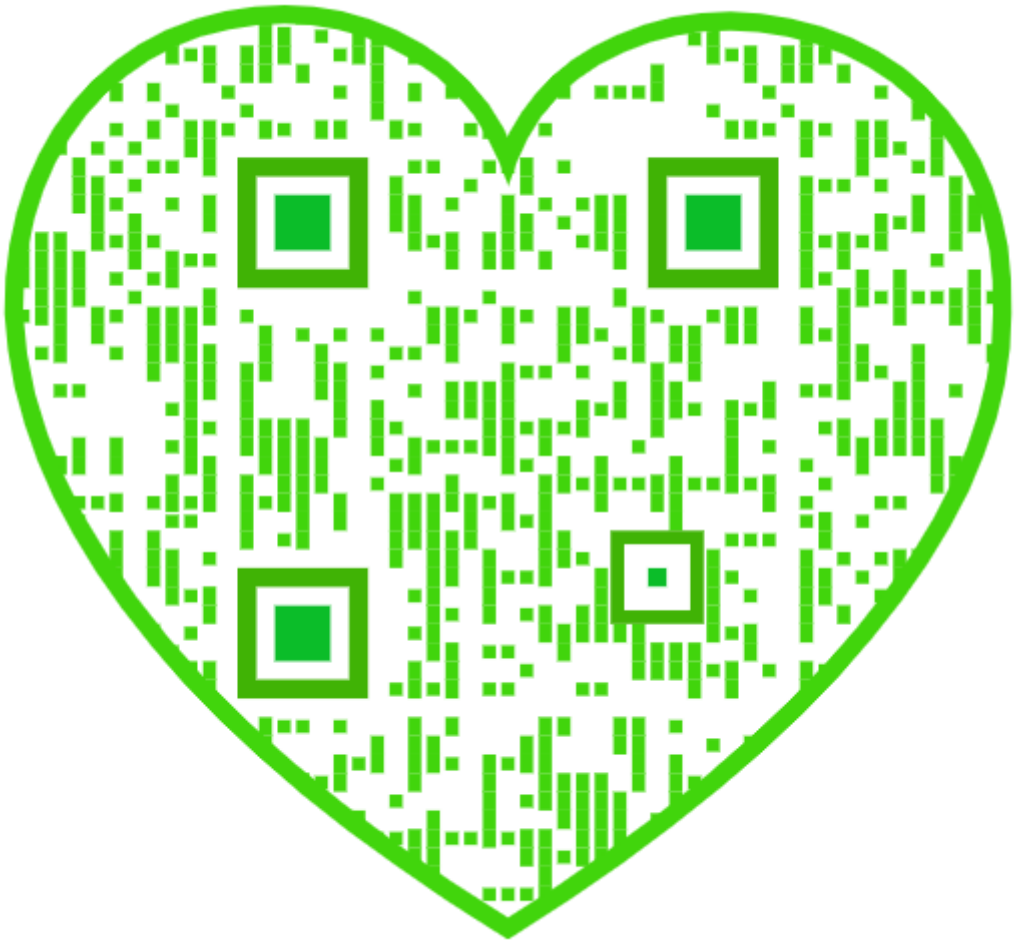

SURGICAL DIAGNOSIS

A

MANUAL FOR PRACTITIONERS OF MEDICINE AND SURGERY

BY

OTTO G. T. KILIANI, M.D.

Surgeon to the German Hospital, Member of the New York Surgical Society, of the Surgical Society of Berlin (Germany), etc.

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To the Memory of my Revered Teachers

Richard von Volkmann

and

Max Schede

PREFACE.

Surgical Diagnosis is really a contradictio in adjecto. There can be only one diagnosis, *i.e.*, the true scientific diagnosis in medicine. Surgery has to do only with the treatment. This explains the seeming paradox that surgical diagnosis is made, not by the surgeon, but by the general practitioner. The real difficulty lies in the fact that the decision as to when surgical interference becomes advisable, rests with the physician, who necessarily must lack, to a certain extent, the experience as a diagnostician acquired by the surgeon in his daily work.

I have endeavored to describe in the introductory chapter the various methods of examination and how to carry them out properly. The special part has been arranged in anatomical order, beginning at the head, following the example of von Bergmann's "Handbuch der praktischen Chirurgie." No claim is made for originality in this work; on the contrary, I have deemed it not only permissible, but necessary, to collect from everywhere the best, sometimes even in the form of quotations. No authorities have been given, as this would have exceeded the scope of the book. In most instances, I have given the consensus of opinion of the best recognized authorities. Where surgical questions were of too recent date to be decided definitely, I have stated my personal opinion, founded upon my own experience.

My object has been twofold: to describe, as exactly as possible, the symptoms peculiar to a disease, on which a diagnosis can be based, and, wherever feasible, to show how to observe these symptoms. If this book should assist the practitioner in deciding the difficult question, whether or not a disease needs surgical interference, my object will have been achieved. The operations which may become necessary and the selection of the particular operation, as well as the prognosis, have been

mentioned only in so far as it is important for the practitioner to know them when proposing operation to his patient.

The tables are all original, with the exception of those where credit is given. Aside from a few figures, which were redrawn after illustrations in standard works, the cuts are original. So also are the plates, without exception. The skiagrams were all taken by Dr. Hermann Fischer, assistant visiting surgeon and skiagraphist to the German Hospital, for whose untiring efforts and skilful execution I wish to express my thanks.

Acknowledgments are due also to my colleagues, Dr. Kammerer and Dr. Meyer, surgeons of the German Hospital, for their readiness to permit the use of skiagrams of cases taken during their service.

In addition I wish to express my thanks to Messrs. William Wood & Company, whose recognition of the need of such a book was the immediate cause of its production, for their unfailing interest in the work, and for the technical excellence of the illustrations.

KILIANI.

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SURGICAL DIAGNOSIS.

INTRODUCTORY CHAPTER.

THIS book is intended for the practitioner. When he is called in, he is expected to treat and, if possible, cure. Frequently a diagnosis is wanted by a patient or his family, but the request for help is always most urgent.

Any therapeutic efforts, however, must necessarily be useless, or worse than useless, without exact scientific diagnosis. Any undue haste is severely avenged.

Modern surgery, with its attractions, has led a great many physicians into surgical work, and as a result probatory incision, without due preparation or a diagnosis, is found only too frequently on cards for hospital operations.

Only thorough clinical education, and afterward constant self-discipline in taking up every case systematically, can finally bring about that experience so necessary for the successful practitioner. The question of therapy resulting from the true diagnosis is entirely secondary to the purpose,—all the more so, as very frequently the actual surgical interference has to be left to other hands.

The practitioner is hindered in his efforts toward self-education in diagnosis by the fact that he very often is not in the position to verify the same, as the surgeon can do with the constant autopsies *in vivo* upon the operating table.

Wherever possible, no opportunities should be allowed to pass to follow up one's own cases,—a practice which is not pursued half enough, according to my experience. It is of very little value for a practitioner to watch big operations, which he probably will never execute himself, if he has not had a chance beforehand to examine the case for himself and to make himself familiar with its entire history.

In many a case the proper diagnosis will lead the physician to leave a disease severely alone, and not to try any operative procedure unless

compelled to do so by circumstances; but even if the diagnostician operate himself, many a useless operation is prevented by an exact diagnosis,—useless in the sense of unnecessary, as well as impossible. On the other hand, nothing guides an operator to more advantage in his work than exact diagnosis.

Methods of Examination.

Diagnosis defined.

Diagnosis is the analytic method of drawing conclusions from concrete facts correctly observed. In other words, we first have to observe facts, and then interpret the same, which leads us by the inductive method to the cognition of a certain existing disease. The observation of the facts in the case is, if rightly done, the more reliable part of the diagnosis, while fallacious conclusions are sometimes unavoidable, even with the greatest care. If we remember that "a miracle is a fact inaccurately observed," we understand the utmost necessity of accuracy in our observations.

We observe with our senses, which are not equally reliable. By far the best results we get:

First, by **inspection**. It seems incredible to the beginner how much can be determined by simply looking at the patient; nevertheless, a good many diagnoses are made simply by inspection, while in other cases it forms the most important fundament for further investigation.

Second in importance is the touch, or **palpation**. How much less reliable the latter is, in comparison with the first, is shown by the fact that without the aid of the eye, you would never know that you have an accurately arranged system of tactile ridges on the points of your fingers, a fact which evades your mind entirely by simply running one finger tip over the other. These are the two senses which we use most in trying to ascertain facts.

Third, **hearing**. Fourth, **smell**. Fifth, **taste**. These are used comparatively rarely in connection with our task.

Inspection.

To see correctly, and to see all that is to be seen, is a faculty acquired only by a long course of education. We have to know what to look for, in order to see things which otherwise remain unobserved. On the other hand, we have—to use an "Irish bull"—to see those things which are not there, that is, we have to establish the fact that certain symptoms which might be present together with the other facts observed, are absent, so that we can come to the final inference *per exclusionem*.

With the eye we can observe:

First, color.

Second, form.

Third, action; *i.e.*, disturbances in functional motions.

Besides, the experienced observer gets other impressions with his eyes, which might be called general; for instance, the expression in the face of a patient. Whoever has observed a number of patients with peritonitis can never forget and will always recognize the *facies peritonealis* when it is before him.

The **color** of the normal integument is produced by two factors: the pigment and the blood. Between the simple presence or absence of either one in the skin there are thus innumerable shades, which can be recognized only by experience. The importance of the latter, for instance, is plain to everybody, when we remember that the vital diagnosis of internal hemorrhage can be frequently made from the deathly pallor of the face, no pink color or redness being present; even the lips turned outward fail to show anything but whiteness.

Case. For illustration let me cite one case of my experience, where a man, standing on the rear platform of a street-car, was hit by the knob of the handle of the rear brake, which whirled around with great force the moment the operator on the front platform disengaged the brake-chain. The man was struck in the loin, becoming unconscious after a very short while, and was brought to the hospital within about fifteen minutes of the accident. The anamnestic fact that he had been hit in the loin, his deathly pale face with its anxious expression and restlessness (common to all patients who have lost a great deal of blood), established immediately to me the diagnosis, internal hemorrhage, specifically of the kidney corresponding to the side in which he had been hit—in fact, laceration of the kidney. An immediate incision over the region affected verified the diagnosis, showing the kidney torn in two in its lower half. Several stitches in the kidney stopped the hemorrhage. Saline infusion and further treatment did the rest and saved the patient.

To cite another instance. It is possible for a close observer to detect a faint paleness over the highest point of a dislocated head of the radius at the elbow-joint, the pressure from below cutting off the blood supply by the capillary system of the affected region.

The familiar picture of the black eye is easily recognized by anybody, the affected part having come into contact with a foreign body thrust forward with sudden violence,—usually another man's fist. The experienced examiner, however, will not be satisfied with this most proba-

ble diagnosis, but will make sure that this suggillation of blood into the eye and its surroundings has not been produced from within, viz., from behind the eyeball, which would indicate a fracture of the base of the skull.

I will deal later on with the different grades of **redness** of the skin, which tells us a great deal in many cases in our course of examination.

Other shades of color.

If the regular course of distribution of the products of the liver—when bile enters into the biliary capillaries, and sugar and urea are carried into the blood—is disturbed, so that bile is directly introduced into the latter, we get the clinical picture of **icterus**. This may be of the highest value in the recognition of certain diseases of the gall-bladder. Other unusual tints of the skin, like the gray, metallic aspect of patients who have been treated for a long while with silver preparations, are of more interest to the internist; although if a woman with such a complexion is brought to the observation of the surgeon, he naturally suspects an ulcer of the stomach, which has been treated by large doses internally of nitrate of silver. To name a few examples of pigmentation, it is only necessary to mention the brown spots in the skin, as the residuum of a chronic irritation from a syphilitic ulcer, or the darkest shade of brown which comes to our observation, viz., the black color of dry gangrene. The latter is so significant that even the layman does not expect to save his toe when it has turned black without apparent cause from senile gangrene. Black is the color of death.

I also should mention the **transpicuity** of the skin, which permits the angioma to shine through the cuticle above it. Finally we must not forget the **translucency**, which is of such value in the differential diagnosis between the hydrocele, which, if properly held against the light, will appear transparent through the stethoscope, and the hernia, which does not permit the light to shine through.

To recognize pathological forms it is of course necessary to know the normal conditions. The former may be either an **increase** or a **decrease of mass**. The commonest form of increase is **swelling**, which may show a different character by being either circumscript or diffuse. To overcome this difficulty of observing a swelling, or any change of form, it is of great advantage to compare the affected side with the other, normal one. This may be done in spite of the well-established fact that hardly any person is, in the ideal sense, built symmetrically; not to speak of the physical hypertrophy of extremities used with preference, as, for instance, the right arm of persons who are right-handed. Other tricks

To detect abnormal forms by comparison with normal ones.

in the technics of seeing differences in form are acquired by experience, as, for instance, placing the object to be examined in such a position that the height of a protuberance appears in silhouette against a background, and then looking at it from the right distance, like a sculptor or a painter who retreats a few steps to get the impression wanted in its entirety. Furthermore, a slight diffuse swelling will show more in a lateral light.

The decrease of mass may show itself in any form, from **atrophy** of a group of muscles, for instance, to hollow indentation, as produced by a dislocation of the head of the humerus, or to a complete **defect**, where a certain part of the body is missing.

Deformity.

Other deformities, which concern either the axis of a certain part of the skeleton, or the change of position in relation to another part of the skeleton, are illustrated by a fracture of the femur and a case of hip-joint disease; both affections concern the femur and are near each other in their localization. It is possible to make either of the diagnoses, practically with certainty, by simple inspection, without making the mistake of jumping at conclusions. Let us take up a fracture of the femur in the middle of its diaphysis. Looking at such a patient, we first see, even if the clothes are not removed, that the foot has fallen over outward. We further see, if we tell the patient to lift up the extended limb, that he cannot do so. If we finally look at the seat of the injury, we find a deviation of the bone from its normal axis, forming an obtuse angle toward the mesial line, which cannot be hidden, even by muscles ever so strongly developed.

Diagnosis of fracture of femur.

The relation of the femur to the pelvis in hip-joint disease cannot better be illustrated than by a working model which my revered teacher, the late Professor Richard von Volkmann, made use of, which I try to reproduce by schematic drawings, Fig. 1.

If we look at a patient with **hip-joint disease** in the third stage, lying flat on a table, we see that the affected limb is shorter than the sound one, an observation which is deceptive, as the shortening is only apparent, and is brought about in the following way: The affected limb is drawn into **adduction** toward the mesial line, thus forming an acute angle with the horizontal diameter of the pelvis, which passes through the processus spinosus ossis ilii of both sides. As this adduction would necessitate the crossing of the legs, this position cannot be and is not endured by the patient. The acute angle of the affected side is fixed, *i.e.*, unchangeable, by certain conditions which shall be explained later on in the special part. To get the legs parallel, the patient therefore

Explanation of apparent shortening of leg in hip-joint disease.

lowers the sound side of the pelvis, thus changing its right angle into an obtuse one and elongating his sound limb. This explains the **apparent shortening** of the affected limb. If we put the patient under deep narcosis, where the cramp which produced the fixation is relaxed, and pull hard at the affected limb, the shortening disappears completely. But this is not by any means all we see in a case of hip-joint disease. We observe further that besides this apparent shortening there is a decided **flexion** in the knee-joint and, though not so marked, a **rotation**

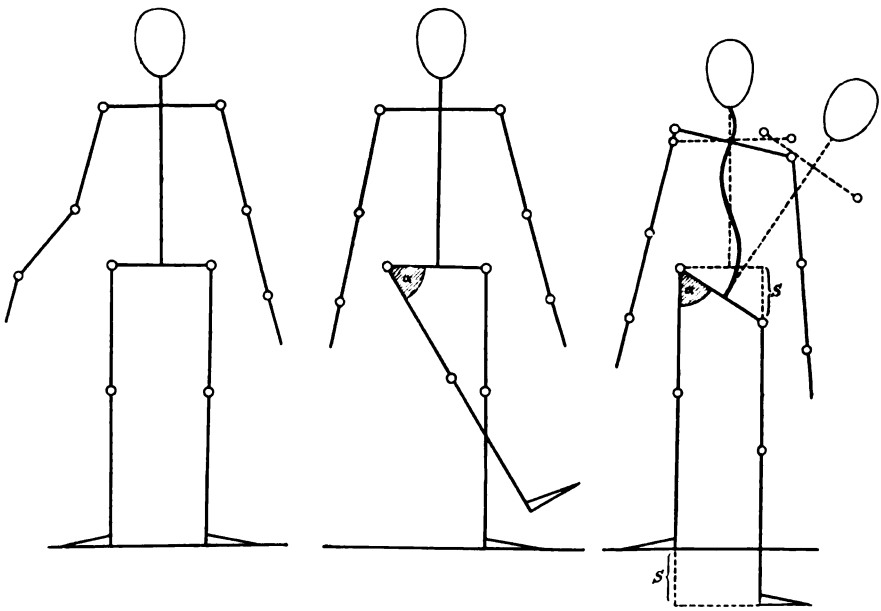


FIG. 1.—*a*, Normal position of pelvis. *b*, Fixed angle caused by adduction of femur denoted by α. *c*, Adaptation by lowering sound hip; *S*, apparent shortening, equal to *S*, lowering of pelvis. Retaining spine in upright position results in scoliosis.

inward. But we are not through yet. After the shortening, the flexion, and the rotation have been done away with, we stand by the side of the patient and find that we can see through the arch of the back, where the lower part of the spine does not rest on the table. This position is produced by the rotation of the pelvis downward. This arching, called **lordosis**, disappears by elevating the affected limb. Having done this, the axis of the limb, in its elevated position, forms with the table the exact angle by which the pelvis has been rotated.

Measuring.

In a number of instances, we make use of certain **instruments** to aid our vision, or to make observation by inspection possible. If we try to

measure a certain distance we can simply do it by sight, a method which is reliable only for very small measures, and then only with a good observer, *i.e.*, a man who has trained his eye for that purpose. In most cases it is much more reliable to use a ruler or, better, a tape measure, which must be either of steel or of well woven tape, which does not allow stretching. Furthermore, we make use of the **calipers** to measure the diameter of a mass, or the distance between two points without leading a tape measure over the surface, which may be irregular. To measure a certain angle, for instance, of flexion in the elbow-joint, we apply the **caliper square** (a draughtsman's square having a graduated bar and adjustable jaws). To measure approximately the curve of a scoliosis, we use a strip of sheet lead, which is pressed against the body to correspond with the deformity and then laid carefully on a sheet of paper, which permits us to follow the lines. **Autoprints** are made for flat-feet, for instance, by blackening glazed paper with smoke and causing the patient to place his feet upon it. If the prints are fixed by spraying varnish on them, they can be kept for records. At other times we make plaster casts to study complicated forms. Finally, there are special apparatuses for measuring shortening of limbs and a number of different scoliosometers as advised by Zander, Beely, v. Mikulicz, and others.

Electric devices.

There are a large number of instruments to make inspection possible by directing light on the affected parts. Electricity has developed this part of our science greatly, as it has so many others. They may be classified as instruments of **diaphany** and such for **illumination**. The first has been used, for instance, by placing a small electric light in the mouth of the patient to determine if Highmore's cavity is diaphanous or not, the latter condition indicating an empyema. If I mention here the gastrodiaphany as advised by Einhorn, it is only to warn against it, as it is worse than a useless toy, the gastrodiaphany not only not showing anything of value, but misleading the diagnostician by its unreliable results. The most exact and important invention for throwing light into the interior of an organ is the **ophthalmoscope** invented by von Helmholtz; besides this we use otoscopy, pharyngoscopy, laryngoscopy, bronchoscopy, œsophagoscopy, rectoscopy, urethroscopy, and cystoscopy. Of immeasurable value, though at first somewhat overrated, is **radiography** or skiagraphy, invented by **Roentgen**.

All these special methods of examination by instruments have first to be learned technically, *i.e.*, the examiner has first to make himself familiar with the use of the instruments, and after having mastered this

task, it is necessary to become acquainted with the pathological pictures to be seen. All this is possible only after a good deal of experience. While it may seem unnecessary for a general practitioner to be conversant with all the ways of examination named above, some of them are absolutely indispensable to every physician.

Combination of methods.

Very often we have to combine different methods of observation to come to a conclusion. We have to use our eyes and fingers (inspection and palpation) to find out if a certain spot is tender on pressure. We have to listen while we palpate, in moving fragments of a fracture to hear crepitation, etc.

The observation of pathological **motion**, or pathological **fixation** where there ought to be motion, is a more complicated act of conception. We have to know the physiological action of a joint, to be able to determine the diminution or engrossment of the same.

The **examination of inner organs** which need surgical interference brings into play the entire apparatus of internal medicine, the difference being only in the therapy applied. Such is the case with diseases of the brain, the lungs, the liver with its adnexa, the stomach and pancreas, kidneys, etc. We thus very frequently need chemical examination, of urine for instance, or the contents of the stomach, etc.

Most important information is gained by a **microscopical** examination of secretions and excretions, and of portions of tumors, etc., excised for this purpose. Still other methods are represented by **cryoscopy** for the determination of the freezing point of blood. As we are never to treat the disease, but the patient afflicted with it, we, of course, have to take into serious consideration his general condition. **Pulse, temperature,** and **respiration** are in every disease of the highest value.

Aspiration.

Another instrument has to be mentioned to help inspection in an indirect way, viz., the **aspiration needle**, with which we ascertain the presence and character of pathological **fluids.** It seems to me necessary to say a few words here about the use of the aspiration needle. It is of course not to be used until inspection and palpation have given us a probable diagnosis of the presence of fluid (serum or pus); but we must not forget the possible fallacy of our probable diagnosis of pus, for instance, and exclude as far as feasible other possibilities, *e.g.*, aneurism. It would not be very agreeable inadvertently to puncture an aneurism, where we expect an abscess. As to the technique of aspiration, we must consider its execution a surgical operation. It may be an exact reproduction of a bacteriological experiment— charging a needle with infec-

tious material of one or several kinds and inserting the same into a nutritive medium,—in one case gelatin or agar-agar, or the like, in the other case living tissue; the result is the same. Under favorable circumstances a culture will grow. To prevent carrying infectious material into deeper layers of tissue, we have to use, therefore, the utmost care in sterilizing all parts concerned, viz., First, the hands of the operator. Secondly, the skin to be perforated. Thirdly, the instrument to be inserted.

Sterilization of all parts.

As to further technique, we need only mention that sometimes we get a negative result simply because the needle is too fine and becomes clogged. In any case, only a positive result of aspiration is of value, while a negative result very frequently does not prove anything.

Those cases in which probatory puncture is permissible will be touched upon when dealing with the different diseases.

Palpation is examination by our fingers and hands, and the sense of touch, if properly developed, may tell us a number of facts; but it is not to be applied until inspection—which is so much more reliable, as stated above—is exhausted. This is a necessity always, as otherwise we would not know where to lay our hands, nor what we have to expect to feel. To feel anything, the examiner has to be in proper condition. One cannot feel with fingers frozen stiff. Thorough washing of one's hands in warm water, always preceding the examination of the patient, for obvious reasons, does away with the coldness of hands and fingers. Further, it should be mentioned that as little force as possible should be used, not only so that we do not hurt the patient unnecessarily, but because the tactile sense of our finger tips becomes impaired by undue pressure. We can feel the **localization** and the site of a mass or establish the fact of an absence of the mass—for instance, the absence of the thyroid gland. Besides this, we can make out with our hands the **size** of the mass, its **form** (especially its surface), its **consistency, mobility, local temperature,** eventually **fluctuation** or **undulation.** For describing the results of our investigation we cannot do better than imitate or use the expressions of the pathologist, whose descriptive words are of astounding accuracy. For common use, however, it is sufficient to say of localization that the mass is cutaneous, subcutaneous, possibly intramuscular, subfascial, above or below certain other organs of the body, posibly intra- or retroperitoneal. To determine the size, we use comparison with well-known objects. For very large sizes we are somewhat at a loss for a measure until we come to an object the size of a man's head or a cocoanut, then

What we can feel.

Determination of size.

possibly a child's head, though this is rather indefinite, then an orange, then one exact measure (which is a billiard ball) down to plum, walnut, robin's egg, cherry, bean, pea, cherry stone, grain of millet, or poppy seed.

Plasticity.

Of great importance is the plasticity of the tissue, *i.e.*, a certain **doughiness** of the same, which permits the impression of the finger. The indentation fills up very slowly. This quality helps us to recognize **œdema**, while a related condition exists in atheromas, if they are not filled out to their utmost capacity.

If we take up now the **local temperature,** which is easy to discern for any hand (besides for fine differentiation we possess the surface-thermometer), we can proceed with mobility, fluctuation, and undulation, which belong to a certain extent to the same group. All three of them are very deceptive, most so, perhaps, **mobility.** Tuberculous or carcinomatous glands of the neck, which involve not only the sterno-cleido-mastoid, but also the jugular vein and possibly the internal carotid, are invariably spoken of as "movable." The same happens with cancer of the breast which has grown entirely through the pectoral muscles. Why? Simply because the observer moves the underlying tissue with the tumor without noticing this fact. This leads us to a point which might well be mentioned here, *i.e.*, the position of the patient to be examined by palpation. In the two cases just mentioned, we need fixation of the muscles involved by the tumor, which is produced at the neck by lowering the head on the non-afflicted side, and by elevation of the arm in the case of cancer of the breast. If we then make use of another trick, which consists in moving the mass up and down in the direction of the muscle instead of across, we at once will find the incorrectness of the first diagnosis, mobility. In other cases we need entire relaxation of the overlying muscles, as, for instance, in the examination of abdominal tumors. To produce this, we let the patients lie on their back and draw up the knees, and let them take deep breath. If this prove insufficient, we have to resort to narcosis.

Position of patient for palpation.

Fluctuation we have to decide on practically every day, but, nevertheless, there is hardly a part of medicine where more mistakes are made. The method usually described is thus: one or more fingers of the hands of the examiner are laid on the corresponding sides of the swelling to be examined for fluctuation, according to its size; then we try to push the fluid from the pressing toward the receiving finger, which is addressed to feel the dislodgment of fluid. After this the fluid retreats and beats

How to detect fluctuation.

against the finger which pressed at the beginning of the experiment. This phenomenon has to be observed very frequently, if possible under guidance where mistakes are rectified, to be able to rely on it. The senseless pressing and releasing at the same time, practised by beginners, is appalling to see. No wonder that the diagnosis, fluctuation, is mostly guesswork.

How to produce undulation.

In contrast with the former phenomenon, **undulation** is produced in a way analogous to the oscillation of the surface of a pond when we throw in a stone. Undulation is mostly observed with free abdominal ascites, and the fact established in the following manner: the one hand is laid flat opposite the other, with which we give a sudden impulse by flicking or flipping, imitating the motion to remove a speck of dust. The wave thus produced in the fluid undulates through the entire cavity and strikes the receiving flat hand. This wave, in contrast to that of fluctuation, does not return and is, therefore, not to be felt by the hand producing the impetus. While it appears desirable that all our observations for diagnostic purposes should be made with such exactness that the single establishment of the fact is sufficient, in fluctuation and undulation the experiment has to be repeated to make sure.

Finally, a very important point must not be overlooked, *i.e.*, if in our examination we have to deal with a wound or not. In case of a **lesion** of the integument, we of course have to **sterilize** our hands as thoroughly as for a laparotomy.

To help in palpation there are a number of instruments called **sounds** or **probes**. Where we probe physiological cavities or meatuses, like the œsophagus or the urethra for stricture, or the bladder for stones, matters are comparatively simple, as we have to abstain only from the use of undue force. It is well known how disastrous the use of force in handling the whalebone sound for the œsophagus may become, if we thus perforate the soft carcinoma above the stricture, or if we make a false way in sounding the urethra or catheterizing, producing an infiltration of urine.

But if we have to deal with a **wound** or **fistula,** which makes the use of the probe desirable, matters stand quite differently. The attraction exerted by a wound canal or fistula on the examining practitioner is truly a fatality. I always try to impress my pupils with the fact that they have no right to use the probe unless they and the patient are prepared for any operation, even capital if necessary. More mischief has been done by the improper and indiscriminate use of the probe than by any other form of malpractice. Of what earthly use can it be to a physician

Danger of the probe.

to push a probe (usually taken from a velvet-lined instrument case) into a man's chest or abdomen to feel a bullet, and thus probably produce an irreparable infection, if he is not prepared for the necessary operation to remove the foreign body?

Pain as a diagnostic factor.

Pain is the most significant of all subjective symptoms, and is therefore of great importance to the examining surgeon. From an unscientific standpoint it is a pity that patients should sometimes suffer as they do, and it is our privilege to alleviate pain or to remove it altogether; but it is also a pity that not every surgical affection hurts. If this were the case, we would not find so many neglected carcinomas or other malignant tumors which have been growing in patients, sometimes for years, apparently without having been noticed. We have to discern spontaneous pain from pain produced on pressure or by moving affected parts. The manifestation of pain varies greatly with different individuals. It is well to remember that in accidents, for instance, people who yell at the top of their voices are rarely severely injured. These sigh, moan, groan, in short, anything but cry aloud. In taking down the history of a case, one has to know the patient or be careful to know how much value may be attached to the statements of the patient about pain connected with his disease. Very frequently pain is confounded with inability to execute a movement; for instance, if a patient says he cannot swallow, he means that it hurts him. Very rarely only is it a patient's intention thus to indicate a complete stenosis of the œsophagus. The **seat of the pain** is also a matter to be investigated carefully. Many patients are not very apt in **localizing** pain and project the same inaccurately. On the other hand, the seat of the pain need not necessarily indicate the seat of the affection; the pain in the hollow of the knee is pathognomonic for hip-joint disease. If we are to recognize pain on pressure, it is not necessary at all to use force. The pressure is to be increased gradually until pain, or its expression, is produced. We will see later of what immense value pain is in the examination of appendicitis. In many a case of appendicitis, pain on pressure in certain regions of the abdomen has tipped the scales toward operation.

Pain also a hindrance.

But pain may also be very much in the way of the examining surgeon. We frequently fail to reduce a dislocation of the shoulder or hip in an individual with well-developed muscles, because he contracts the latter to the utmost to avoid pain or resist reduction, so much so that fractures take place rather than reduction. To overcome this cramplike contraction of muscles solely produced by pain, we have to resort to

narcosis. We have mentioned narcosis before as a help for diagnostic purposes, and in a number of cases we are doubtless compelled to resort to it, but we must never forget that even at the present day general narcosis has its dangers for healthy individuals also; and patients or their relatives ought to be informed of this danger, however remote it may be (1 to 10,000 or 14,000).

In cases in which narcosis for examination purposes becomes a necessity, a certain time ought to be allowed to elapse before a second narcosis for operation is applied.

The **character** of certain forms of **pain** is sometimes so well described by patients that we recognize it at once as the form of pain belonging to a certain disease, as, for instance, the pain a stone in the bladder produces when the patient is jolted, or the pain caused by a gall-stone trying to pass the duct, although this latter form is usually mistaken by the sufferer for cramps in the stomach.

The method of finally reaching a diagnosis after examination of the patient is as follows:

1. **Anamnesis,** by which we gain

A. **Family History.—Hereditary diseases** are of importance, as, **syphilis**, or the existence of certain tendencies to contract diseases, like **tuberculous diathesis,** or the unexplained frequent occurrence of **malignant tumors** in one family. It is usually quite difficult to elicit the fact of hereditary syphilis, most patients repudiating the insinuation that their parents had been affected with this disease. It takes some tact to get at facts like frequent abortions of the mother, etc., which will establish this diagnosis, but the objective signs in the patient, as Hutchinson's teeth, otherwise inexplicable swellings of bones, etc., are usually of more value than the statements of the patient. A hereditary tendency of the highest importance to the surgeon is **hæmophilia,** a fact which can usually be established easily, as the great and sometimes fatal loss of blood is an occurrence which impresses the laymen. It is comparatively as rare as its source is unknown, so rare that a surgeon hardly ever thinks of asking for the possibility, and the fact that the patient is a hæmophile is usually established only after he begins to bleed. We may say that hæmophilia is usually limited to the male members of the family. As to the expression "family," it is not necessary that the immediate ascendants were affected with a certain disease, but some tendencies like hæmophilia, springing finger, etc., are sometimes found in uncle and nephew or in even farther degrees of relationship.

Hereditary disposition.

B. **Personal history** has to deal with **diseases** previously **acquired** by the patient, as well as **habits** in regard to the use of tobacco, alcoholic drinks, etc., and his occupation.

C. **History of the Affection.**—The more we progress in diagnosing our case, the more carefully and minutely the examination must be made, and the more value we may attach to what we find. This part of the anamnesis has to be made with the greatest care and precision, and dates are to be gained as carefully as possible. The time during which an affection has existed is of great value. If the patient has had a tumor for twelve years without its growing perceptibly, it cannot very well be a carcinoma. The value of **dates of symptoms**—which developed first and which later on—varies greatly according to the intelligence and gift of observation of the patient. Even people quite bright and with good education are found to be remarkably dull in observing matters that concern their bodily welfare. On the other hand, over-anxious parents will tell of instances which have no bearing whatsoever on the case, and it is necessary "to separate the grain from the chaff." The etiology or cause of a disease given by the patient must not be accepted until corroborated by the physician's own conception of the case. Every physician of experience knows of the child who acquired spondylitis after the careless nurse let the baby roll off a piano. Nevertheless, a certain importance has to be attached to the **influence of injuries** in starting a disease or developing it. The injury not very rarely creates a *locus minoris resistentiæ*, where infectious material, either from outside or by way of lymph or blood, is carried and grows there. To prove this by experiments on animals, F. Krause infected rabbits with tuberculosis. If left alone, these animals would develop general tuberculosis, while if, after the infection, he wrenched or crushed joints, especially the knee-joint, in a vise, those animals developed local tuberculosis. Arthritis, even leading to suppuration, develops after typhoid in joints where there were former lesions. It is an open question if **tumors**, especially carcinoma, do not develop after **insult to tissue**, be it single or multiple. All the old teachers in surgery were convinced that epithelioma of the lip developed only with pipe-smokers, and von Volkmann used to tell us how happy he was when the first woman he ever saw affected with carcinoma of the lower lip smoked the pipe also. The further development of an affection has to be found out, as well as the treatment resorted to up to the time of our present examination. We must not forget, however, that while we frequently must help the patient by adequate ques-

Dates of symptoms valuable.

Etiology.

Trauma as an etiological factor.

tions, we must not cross-examine him as a district attorney does, by insinuating, and thus get answers where the patient does not say what he wants to, but what we want.

In cases of injury, of course, it is easiest to get the history, unless the patient is brought in unconscious without any witness of the accident.

Physical examination of patient.

Status Præsens.—The **result of the examination** of the patient is by far the most important factor in leading us to the correct diagnosis. We shall here separate injuries from diseases, as we shall do later on. It would be unnecessary and inappropriate to examine all parts of the patient with the same scrutiny in a case of Colles' fracture as we use to establish the diagnosis of tuberculosis of the kidney; but one thing must not be forgotten: that in cases of injury, other lesions may exist besides the one which catches the eye.

I shall endeavor to describe only the **general examination** now, as the examination of the different parts of the body will be dealt with under their headings. I have to repeat that to get accustomed to a **methodical** way of reaching a diagnosis, it is absolutely necessary to go through the entire course of examination, not omitting anything because it apparently has no bearing upon the case; and I here reiterate my warning against the snap diagnosis, which in certain cases the experienced surgeon may indulge in, but even he only at the risk of mistakes.

To be able to examine a patient thoroughly, it is necessary to have him **entirely undressed.** One of the reasons why examinations in hospitals are usually more complete is to be found in this point. The modesty of patients need not be offended by this procedure, if done rightly.

1. We perceive the general **appearance** of the patient, general nutrition of body, striking deformities, expression of face; if conscious, whether at ease or in distress.

Position assumed by patient.

2. The **position** of the patient if he is in bed. Patients whose general system is not seriously affected have a certain tonus of their muscles, while very sick persons lie entirely relaxed and have a tendency to slip down in their bed. Many positions are significant of certain diseases, as tetanuslike position in cerebral meningitis, the drawn-up knees in peritonitis, and the lying of the patient on one side in pleurisy and empyema, etc. The specific position of limbs in affections of the extremities will be dealt with later on.

The **color of the lips** can tell us a great deal. As mentioned above, if they are very pale, they may indicate one acute hemorrhage or a num-

ber of preceding ones; if they are blue, they are a sign of cyanosis, where too much carbonic acid gas is carried in the vessels and not enough oxygen is present. This state we find where the respiratory tract is obstructed by foreign bodies, or, as in diphtheria or glottic œdema, by swelling of the inner coat of the air passages, or where the larger part of the lungs is prevented from doing its duty, as in empyema.

3. **The skin.** The different conditions of the skin in relation to scars, pigmentation, or changes in the blood supply have been described in a general way above (see page 4).

4. **Pulse,** temperature, and respiration have to be taken and noted carefully.

5. A cursory **examination** of **heart, lungs,** and **kidneys** has to be carried out in all cases, though it may become necessary to repeat the same more exactly if there are any indications of an affection of these organs.

Injuries to the Skin. Wounds in General.

So many different conditions are possible which a patient with a **wound** can present that we have to act accordingly for our diagnostic purposes. Generally speaking the wound has been produced by a mechanical influence,—**cut, bruise, tear,** etc. It is a different thing if a man walks up to you and shows you a fresh cut on his finger, or if a person lies on the floor with his thigh nearly severed from his body. In the first case you have all the time you want to consider and investigate, in the other case quick action is of vital importance. As it is not our province to describe how to treat wounds, I shall only explain what to do in order to be able to examine the wound and how to do the same. We cannot examine a wound while the blood is spurting from it. We have, therefore, in such cases to make a therapeutic effort in order to be able to come to a diagnosis. In extremities, serious hemorrhage is stopped by application of Esmarch's bandage, as is well known. In other soft parts, a pressure bandage, as much as circumstances will allow, is used to stop a **hemorrhage,** and further examination for diagnostic purposes is to be deferred until the patient is on the operating table, where everything is prepared, not only for the stoppage of the hemorrhage, but for the treatment of the wound as well. This leads us to the chapter, **how to examine a wound.** Quite frequently the proverb "the least done, the soonest mended" proves correct. I need only to remind you of the fact that as far back as in the Turko-Russian War of 1877

How to examine a wound.

von Bergmann, who volunteered as surgeon, had sixty-four cases of **gunshot wounds of joints** healed by primary union simply because the wounds were never touched or probed, but only dressed with a dry antiseptic dressing on the battlefield. The same experience has been repeated in the Boer War, of which we have very good reports as far as the surgical work is concerned. The conclusion to be drawn from this is that **for purely diagnostic purposes, wounds cannot be too severely left alone.** This holds good of course for fresh wounds.

Wounds heal if left alone.

The character of the **wound changes** very much after some time has elapsed, and **infection** has not been prevented. For comparison's sake it is necessary to describe shortly the further fate of an **aseptic wound.** The edges of the skin and deeper layers, if united or not, are sharp, straight, not swollen, and of the same color as normal. If the edges are united, the wound keeps this appearance as described, and heals within from four to six days. If left to itself, the wound will heal by **secondary intention,** if no serious infection takes place. Granulations then are formed, which look, if healthy, like the globules of the raspberry, and discharge sero-purulent fluid, the "*pus bonum et laudabile*" of former times. If an **infection** has taken place, which only—or at least for practical purposes only—happens by **contact,** the clinical aspect is completely changed. The wound is covered with a grayish, yellowish coating not unlike a diphtheritic membrane, the edges get red and swollen, and the wound discharges pus of creamy color, with or without a specific odor. The presence of special bacteria may cause the pus to become greenish to green or blue. Such a wound becomes extremely tender, spontaneously as well as on pressure, while a wound healing by primary union is practically painless after twenty-four hours.

An infected wound.

It is very hard to decide if a comparatively fresh wound is **infected or not.** To determine this we have, to a certain degree, to rely upon the anamnestic data. As soon as any attempts have been made by the patient or well-meaning bystanders to wash out (?) the wound or apply any of the customary methods of stopping bleeding, it has to be regarded as infected, and treated accordingly. **Clean cuts,** where no clothing was first severed, which have not been treated at all and not been soiled afterward, may be **regarded as fresh** and comparatively aseptic wounds, and may be closed. All **lacerated wounds,** where partial necrosis is apt to take place in the course of healing, are best **regarded as infected.** The exploration of any deep or extensive wound, with or without the possibility of a foreign body, like the point of a knife, bullet,

How an infection occurs.

etc., has to be left to a well-prepared operator in an operating room, if possible.

It is useless to make a number of subdivisions of all the different kinds of wounds; may it suffice to consider the **incised wound** or **cut,** the **contused wound,** and the above-mentioned **laceration.**

Reparatory power of wounds.

One thing is still to be considered as important, and that is, the diagnostic point whether certain parts of tissue in a wound are **beyond reparation** and may be considered as physiologically dead. Quite frequently this decision is so difficult that the experienced surgeon rather leaves it to time. One cannot be too conservative with important organs, and with the right treatment this postponement of a decision does no harm. The **strangulation** of the **gut** in an incarcerated hernia, for instance, may have been so severe and of such long standing that it is very hard to decide if the gut can recover and if it is therefore safe to replace the loosened loop. Gut which only appears blue will recover, especially if you find indications of this process in your short time of observation during the operation. A **white ring** at the seat of the strangulation is always **fatal** to the tissue, but when we are doubtful we carry conservative methods so far as to leave the affected loop outside of the abdomen, sew up the same partly, put on a wet dressing, and wait twenty-four hours to finish the operation. **Splinters of bone** in a compound fracture, which are still adherent to their periosteum, need not be separated and sacrificed, as the power of reparation of the periosteum is very great.

Poison in wounds.

The so-called **poisoned wound** is mostly a **myth.** It is nonsense to assume that the harmless and, if anything, disinfecting aniline color of the red stocking should do any special harm to a wound; in fact, there are no poisoned wounds except those induced by bacteria. In other cases we have to deal with wounds through which the poison entered, as **curare** with its paralyzing effect on the muscles—which very rarely might come under the observation of any practitioner, except through an accident in a physiological laboratory—or **snake poison,** with its more or less marked effect on the central nervous system according to the species of snake, or **hydrophobia,** or **tetanus.** In all these cases the wound as such shows **no specific characteristics,** in fact only the snake poison seems to have some local effect, a dark blue to black ring appearing very soon after the injury.

The Tissues Injured by a Wound.

Wounds of the skin or **mucous membrane** are self-evident and recognizable as such. Where the subcutaneous fat has been severed, it protrudes into the wound. In parts where there is a **fascia,** the lesion of the same can be recognized by a bulging of the underlying tissue, usually muscle. Wounds of **muscles** bleed freely if they have not been bruised too much, when the small vessels become occluded. If the **sheath of a tendon** has been opened, a clear amber-colored, ropy fluid escapes. The sheath of the tendon, as well as the tendon itself, is recognized by its mother-of-pearl color. Neither of them bleeds if cut through. The diagnosis of one or more tendons being severed becomes evident by the inability of the patient to execute the movement characteristic of the tendon in question. An exact knowledge of anatomy is necessary to avoid mistakes. If the **periosteum** has been injured, the examining probe (about the use of which I have expressed my views above) discovers raw bone. As the periosteum is very smooth, the difference is quite marked. If a **joint** has been injured, the fluid described as emanating from the sheath of a tendon is to be found, the only difference being that it is somewhat thicker. It cannot be repeated too often that the **examination** of such parts as mentioned just now **is an operation,** and that the use of the finger for exploration is to be dispensed with as much as possible, as it is practically impossible to sterilize the skin. The appearance of wounds of special organs like brain, liver, kidney, etc., is to be considered later on.

Hemorrhages.

To recognize the different forms of **hemorrhage,** it is only necessary to recall the fact that in smaller wounds, where no large vessels are injured, the hemorrhage is always venous, and arterial where the capillaries only are affected. If the continuity of larger vessels is interrupted, the hemorrhage usually is quite profuse. The **blood** from a **vein is dark and flows.** If a **large vein** centrally located, *i.e.*, near the heart, is cut, **aspiration of air** can take place, which usually results in death within a very short time. This occurrence, though, is much rarer than has been formerly assumed. The **blood** from a severed **artery spurts** and is **bright red.** This differential diagnosis is of importance as any vein, even the largest, "stands" on compression, while arteries have to be ligated *in loco* or at a place of selection. Wounds in their further progress may present conditions which are of diagnostic value. In **per-**

forating wounds, the surface part may have healed, while in the deeper tissues a **hæmatoma** may have formed or **infection** taken place. The hæmatoma is recognized by the swelling produced by it, and under certain conditions fluctuation can be felt. In the other case, a more or less deep-seated **infiltration** can be detected by the examining fingers; besides, wounds of that character are extremely **painful,** spontaneously as well as on pressure.

Our knowledge of anatomy has to tell us where to look for **distant effects** of the infected wound. A panaritium of the volar side of the little finger creeping along the sheath of a tendon may infect the flexor tendon of the thumb, forming a so-called "horseshoe phlegmon," as these tendons and sheaths communicate. Furthermore, we must consider the **lymphatic system** with its glands. If an infection has taken place through a badly cut corn, we observe under certain conditions, within twenty-four or forty-eight hours, a red streak running up the inner side of the leg and thigh to the inguinal region, where the glands become swollen and tender. The glands form a sort of sieve, arresting the infection, which cannot go any farther until the resisting power of the glands infected has been overcome. In this way the **infection** of **regionary glands** has to be considered as a beneficial effect, which prevents, for the time being at least, a general infection. We do not yet know how in certain cases a general infection takes place without following this typical way. We assume that an especially foudroyant infection occurs, which spreads so quickly that there is no time for the development of these other types.

Phlegmons.

Erysipelas.

A special form of wound complication is **erysipelas.** When Fehleisen's streptococcus was discovered, it was assumed that this special bacterium produced erysipelas; since then it has been found that there is neither microscopically nor bacteriologically any difference between the common streptococcus found in any inflammation and the producer of erysipelas. Apparently there are different stages in the life of this microbe, which announce themselves in different effects upon the living tissues. Possibly the new hypermicroscope may lead to new discoveries in this line. That the **microbes** present in erysipelas are of **specific virulency** is proved by its extreme **power of infection** and **spreading.** To recognize erysipelas when it is present is not so easy as is generally assumed, quite frequent mistakes being made in this connection. While it is well to be on the safe side, treating doubtful cases as erysipelas as far as isolation is concerned, the avoidance of mistakes is very desirable.

Symptoms.

In this we are guided to a great extent by watching the **general condition** of the patient. The **clinical picture** of erysipelas, aside from its local aspect, is quite **characteristic.** As a true infectious disease, it carries with it all the typical symptoms. A **severe chill** is usually the signal for the inception of the process, followed by an acute rise of temperature up to 104° or 105° F. The **sensorium** is frequently **obscured,** accompanied by **severe headaches.** The fever is continuous, and stays high with small remissions as long as the infection continues to spread. This keeps pace with the local conditions. The **intense, sharply circumscribed redness** of the skin **spreads** like a **flame,** and very frequently follows such contours. If the wandering is stopped temporarily, a drop in the temperature is observed. A microscopical examination of a section of the skin thus affected shows at that time that the streptococci have advanced farther under the skin than on the surface. When the redness of the skin begins to spread again after an interval, which may last twenty-four hours or so, the temperature goes up again with a jump, and stays high until this phenomenon repeats itself or until the infection has exhausted itself. If we have to deal with an erysipelas of the leg, for instance, and it is wandering downward, it usually does not stop until it reaches the distal end of the same. To observe exactly if the redness has spread, it is well to mark the outlines with a nitrate of silver pencil. **Erysipelas** of the **mucous membranes** is much harder to recognize, but as it usually does not occur without the appearance of erysipelas on the skin, this diagnostic difficulty is of no great importance. As an etiological factor, the habit of some patients to pick their nose is to be taken into consideration, as persons who have infected their hands may thus produce erysipelas of the head. This untidy habit is, therefore, to be stopped as far as possible.

Erysipelas bullosum.

In some cases **blisters** are formed on the skin, "erysipelas bullosum," which may have the size of a pinhead to a walnut. The serum, turning turbid later on, contained in these blisters is of special virulency. The **erysipelas** infection **of the head** is harder to follow as soon as it reaches the hair; besides, the prognosis is considered more infaust than in affection of other parts, leptomeningitis following quite frequently. It may be well to repeat that the diagnosis of erysipelas is of such importance, because it gives us the only chance to avoid infection of other patients. The alarming way in which erysipelas spreads like fire can only be stopped by its early recognition. Since we know that the infection can only be transferred by contact, strictest isolation, combined

with severe antiseptic methods, will enable us to hold such an outbreak in check.

The **diseases of the skin** are only of interest to us in so far as they are clearly surgical, otherwise they belong in the vast field of the skin diseases *per se*. The diagnosis of diseases of the skin shows plainly how much can be done by mere inspection, as nearly all of the characteristics pertaining to an affection of the skin have to be perceived by the eye. We have to deal here only with the **ulcer,** and its near relative, the **fistula.**

Decubitus ulcer.

The form of **ulcer** which we meet mostly in surgery is the atrophic ulcer. It is of little consequence how the nutrition of the affected part is interrupted, if by pressure, as in the case of the **decubitus,** or bed-sore, or by chronic impairment of nutrition, as shown in the common **varicose ulcer** of the leg. The **syphilitic** ulcers of the leg are based upon the same conditions, as they have nothing to do with fresh luetic lesions, but are the result of a chronic **endarteritis.** The decubitus ulcer occurs most frequently in the sacral region of lean patients, if they have to lie for any length of time flat on their back, especially if they have high temperatures. Extreme cleanliness can do a great deal to prevent them, and they are to a certain extent in any serious illness the criterion of good nursing. But they become absolutely unavoidable after **lesions of the spine.** If the patient is paralyzed, say from the tenth dorsal vertebra down, these trophoneurotic ulcers are bound to appear. About the character of these trophoneurotic ulcers we really know very little, and it has to be considered probable that the **anæsthesia of the parts** affected is at least partly responsible for the formation of the ulcers, in so far as the patient does not feel pressure, and, therefore, does not shift as a healthy person would. We find the same conditions in paranoiac patients in insane asylums, where one of the important duties of the nurses consists in keeping the patients on the move, *i.e.*, that they, for instance, do not lean too long on one elbow. To go back to the sacral decubitus ulcers, patients with paralysis, as described above, have no control over bladder or rectum, which materially increases the difficulty of keeping those patients clean. The aspect of the decubitus ulcer is not very characteristic, and its diagnosis has to be formed partly from its location and from the fact that pressure has been exerted on the spot in question. It may be described as follows: first, **redness** appears, then the epidermis breaks down in the centre of the affected spot, a **flat defect** is formed, which becomes rapidly of **yellowish-grayish color.** The edges

Symptoms.

are not very sharp and are not undermined. Finally the defect becomes deeper, forming a cuplike shape, but never assuming the funnel char-

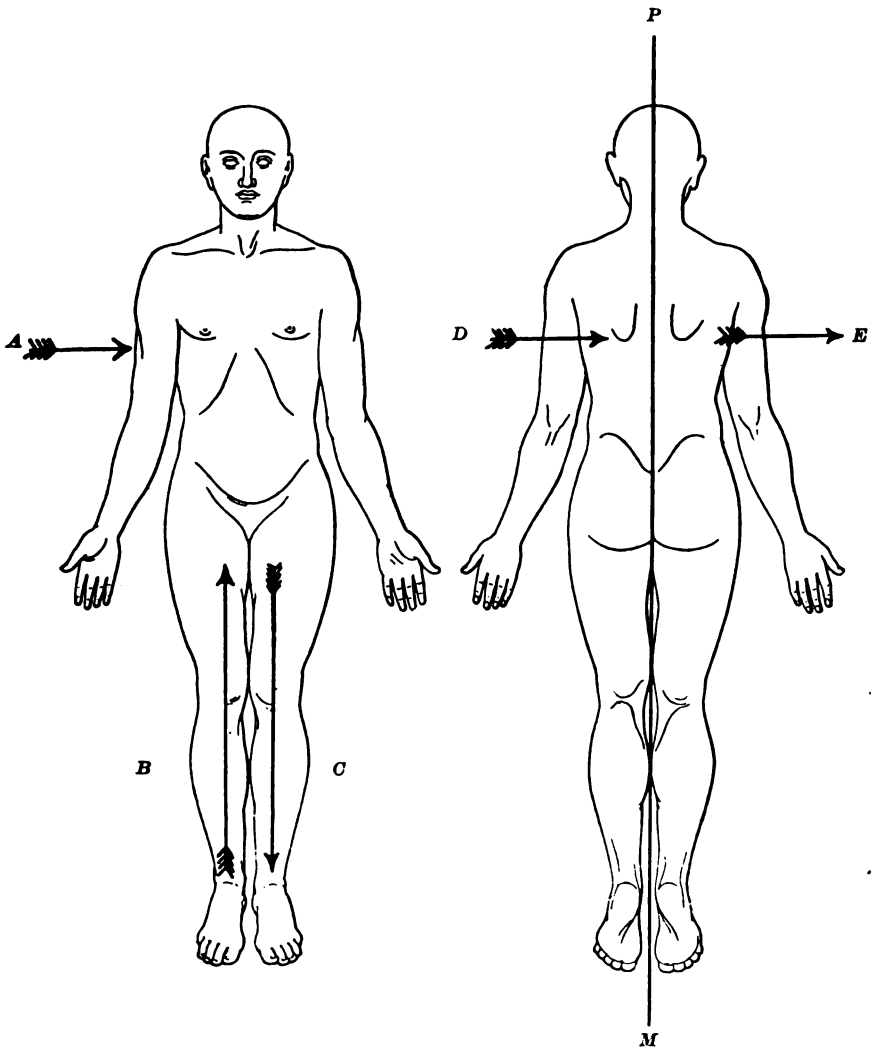


FIG. 2.—Arrow *A* indicates frontal direction, which designates any vertical plane passing through the body and cutting the mesial plane at right angles. Arrow *B* indicates proximal direction. Arrow *C*, distal direction: these terms are used only in regard to the extremities. The line *M P* indicates an imaginary plane of section passing vertically through the body, dividing it accurately into a right and left half; this is called the mesial plane. Arrow *D* indicates central or mesial direction. Arrow *E* indicates lateral direction.

acter. The same ulcers may be produced in otherwise healthy patients by artificial **pressure,** as by a badly fitting **splint,** or by pressure produced

by weight, as in Buck's extension. Where there is no anæsthesia present, as in the latter cases, the production of such ulcers is exceedingly **painful,** and if, for instance, a patient whose leg you have put up in a T-splint complains after six or eight hours of severe pain on the Achilles tendon, it is a sure indication of undue pressure where it ought to be avoided, and the splint has to be at once removed and put on properly.

Differentiation. A paralyzed patient, on the contrary, does not complain of any pain, as there is complete anæsthesia, which makes increased watchfulness necessary.

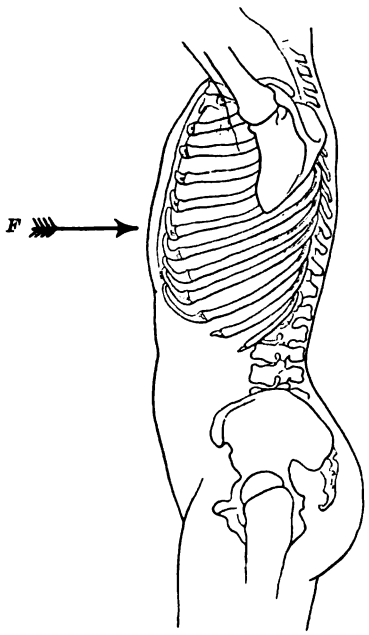
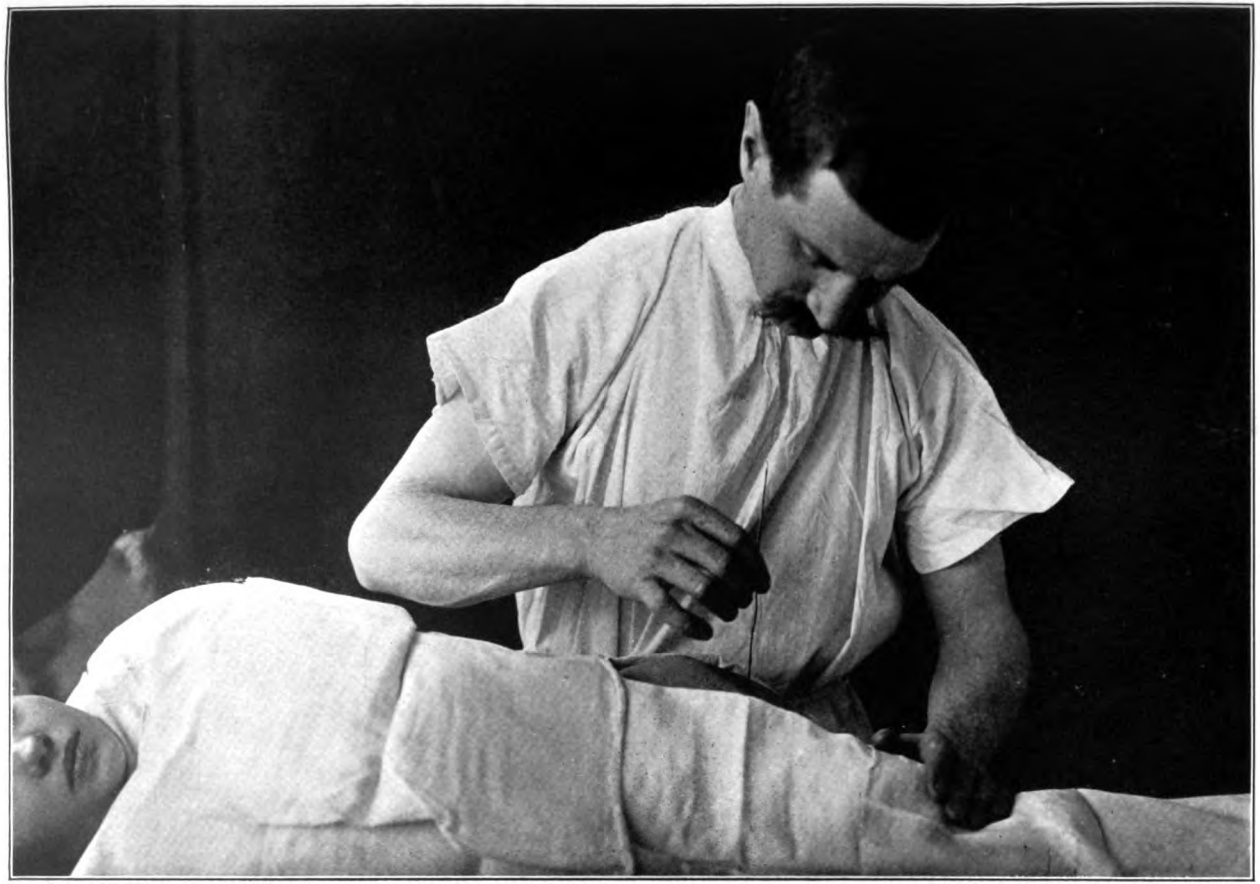


FIG. 3.—Arrow *F* indicates sagittal direction.

The **simple ulcer of the leg** brought about by malnutrition on the basis of varicose veins is not always very readily differentiated from a **syphilitic ulcer.** The rust color and pigmentation of spots, where there have been previous ulcers, as well as the bluish, shiny scar where they have healed, may lead us astray in our differential diagnosis. If the defects of the skin look as if **punched out,** and especially if the form of the ulcer looks as if produced by a number of excentrically punched holes, the diagnosis of the luetic character becomes very probable. The bottom of those ulcers looks different according to the state in which the ulcer is. If it is **inert** and shows no sign of healing, the bottom is perfectly flat and the deeper layers seem to be loosened, while if reparation sets in, very small granulations appear, which in their development bring about the closure of the ulcer.

Fistula. A **fistula** is a **form of ulcer** which is produced from within, in contrast to the form of ulcers described so far. The situation, size, color, and character of surrounding tissues, the eventual discharge from it, can tell us a great deal about the character of a fistula, whether produced by the presence of a foreign body or by an organic disease, as, for instance, tuberculosis. If the fistula shows a protruding, bulging mass of glassy, shiny granulations, you can address it as **tuberculous,** and expect to find unhealthy or dead bone at the bottom of it. For **exploration of the fistula** we use the **probe,** under the above-described precautions. The



PROBING A FISTULA IN HIP-JOINT DISEASE.

Note the "expression" of the right hand, also aseptic preparations for sounding.

FIG. 1.—FIRST STAGE.

FIG. 2.—SECOND STAGE.

METHOD OF INTRODUCTION OF STEEL SOUND.

Note the lightness of touch of the right hand; no force to be used.

common mistake made by the beginner in the use of probes lies in the size selected. He usually takes a probe much too small. The **largest size** of any kind of probe, if it be of metal or soft material, is always the safest, and therefore should invariably be tried first. If the canal is not absolutely smooth and branchless, so to speak, the small probe will be caught by valvelike lips protruding into the lumen of the canal, or it may even pick up the side wall of the canal and carry it along as a sort of hood, which stops the sound in this way. As to the **handling of the probe,** it is impossible to use too little force. The hand of the examiner must appear as if in the act of writing, and careful insertion should thus be tried. If the probe is arrested, you withdraw the instrument partly and try again and again, always bearing in mind that the least use of force may, and will, produce a false passage.

Light touch essential (see Plate 1-3.)

In a number of cases, a **chemical** and **microscopical examination** of the discharge of a fistula will aid us materially in determining where it leads, as, for instance, in fistulas of the gall-bladder, or the perineal urinal fistula. If we mention that fistulas of long standing occasionally close up temporarily, only to break open again after a short while, we may close this chapter.

In explanation of the descriptive terms used in the further course of this book, I give Figs. 2 and 3.

INJURIES AND DISEASES OF THE HEAD.

INJURIES OF THE HEAD.

For the sake of completeness, we have shortly to describe here the **injuries to the head during birth.** They are produced either by the **pressure** of the pelvic passage of the mother, or by the **forceps** applied for extraction. The coroner's physician may have to take into consideration the differential diagnostic points of injuries inflicted to the head before parturition with the intention of criminal abortus. The injuries may be:

1. Erythema and excoriation of the skin.
2. Œdema, suggillation, and extravasation in the deeper layers of the soft parts.
3. Deformities of bones.
4. Severing of continuity of bones.

1. Either the pelvis or the forceps is responsible for lesions of the skin presenting themselves as **erythema and excoriation.** They are the first stages of the decubital ulcers, as described above; the round or longitudinal red spots which usually disappear after a few days may in some cases become necrotic if the pressure exerted on them is severe enough and of long duration.

2. **Œdema,** etc. The typical, circumscript œdema of the scalp is the *caput succedaneum*, which is produced in all head presentations by the fact that all parts of the skull are evenly compressed, except where it is pressed against the orifice of the uterus after the waters have burst. It is therefore considered practically normal and needs no interference whatsoever.

Cephalæmatoma.

A peculiar extravasation on the head of the new-born is the **cephalæmatoma,** which is produced by the forming of a hæmatoma between the periosteum and bone. It occurs in about half of all births.

The reason for it is either the pressure of the maternal parts, as mentioned before, or **fissures** and **impressions** of bone produced during birth. Most of the blood extravasates when the pericranium is partly torn off,

but the bleeding may continue during the first days after birth, the crying of the new-born producing a stasis. This is the reason why they are quite frequently not discovered until two or three days after birth.

Injuries intra partum.

3. **Deformities.** The deformities produced by the act of birth are considered as configurations favorable for expulsion and as practically normal as long as the bones are only shoved over one another, a condition which usually disappears after two or three days. The pressure exerted on a single bone of the skull may appear only as a **flattening** or **arching** of the same, or, which is more serious, the **indentation** may assume the form of grooves, or spoon and funnel-shaped depressions. These injuries *intra partum* are of diagnostic importance, as they may have to be differentiated from criminally inflicted wounds after birth.

4. **Severing of continuity.** It has been proved beyond doubt that actual tearing apart of neighboring bones in the sutures may happen, as well as severing of the condyloid parts of the occipital bone.

Of differential diagnostic importance are **defects** of **ossification**, which occur more frequently in the occipital bone, or, though more rarely, on the parietal bones. These places of predilection, as well as the systematic arrangement, prevent us from mistaking them for fractures.

Injuries of the Soft Parts of the Head.

The soft parts of the head are composed, near the mesial line, of the **skin,** the **epicranial muscle** with its bright sinew, the **galea,** and the **periosteum.** Laterally the temporal muscle with its aponeurosis enters between the skin and periosteum.

1. Wounds by Cut, Thrust and Blow.

Cuts, if not of operative nature, are commonly produced by the use of the **razor** as a weapon, as is the habit of the negro, and may form, as well as a blow with a **sword,** for instance, simple division of skin, or produce flaps, or carry away parts with loss of substance. Wounds by **thrust,** as the stab wounds produced by the Italian's dagger, are usually only **short canals,** unless the instrument used glances off at the bone and perforates the skin at some other place. Very frequently stab wounds not only affect the scalp, but the bony parts as well.

Wounds of the soft parts of the head.

All injuries to the soft parts of the head are of much importance, as there is usually some difficulty in defining their extent. It happens

Extent of injuries to the head.

quite frequently that it is impossible to determine if we have to deal simply with an injury of the soft parts, or a fracture, or injury to the contents of the skull—the brain. This may become the more difficult as the most serious brain symptoms may exist with either form of injury. A good many injuries to the head are received while under the **influence of alcohol,** either in a drunken brawl, or by a fall when intoxicated, or by the club of a resolute night policeman. It is no wonder, with this combination of commotion or concussion of the brain and the symptoms of alcoholism, that mistakes are made by the young ambulance surgeon, which very frequently prove fatal. The cursory examination of an injury to the head, especially of one combined with a wound, can in most cases not lead to a proper diagnosis.

2. Bruises and Contused Wounds.

Bruises.

They are produced by influence of **blunt force** either directly, a blunt object hitting the head, or by a fall on the head. Under the influence of the said force, the underlying bone causes the skin above to be bruised or to break. Bruises are simply **hæmatomas** in the skin and occur most frequently with **children** who have not learned yet to save themselves by stretching out their hands. If there are no symptoms of the brain connected with them, simple bumps are of no significance.

If the effusion of blood is **under the galea,** it may spread far over the cranium. The larger the hæmatoma, the softer and more fluctuating it is to the finger. Its softest part is in the centre, while at the **circumference** a **hard wall** may be felt, so hard that the hæmatoma may be mistaken for a depressed fracture. This mistake is still more probable if the injury has been severe, producing brain symptoms at the same time. To differentiate the hard rim of the hæmatoma from a depressed fracture, we have to remember that the rim of the former is higher than the surrounding surface of the skull, and that we can squeeze and push the infiltration away.

Differentiation of hæmatoma from depressed fracture.

Wounds of the scalp produced by blunt instruments or objects of all kinds, or by a fall on the head, are by far the most frequent. The result of this consists either in a **linear wound** with more or less straight edges, or in **triangular flaps** which are characteristic of such wounds of the scalp. All wounds of the scalp bleed very freely. To find out the extent of a wound, we have, sometimes even for our diagnostic purposes alone, to **stop the hemorrhage.** This is first most effectively done by simple

BURN BY LIVE TROLLEY WIRE CHARGED WITH 2750 VOLTS.

Exposed tabula externa necrotic, later removed by operation. Many severe hemorrhages occurred, typical for electric burns.

compression of the wound. Then after shaving the parts and cleaning with ether, the application of sharp retractors, after stopping the hemorrhage, makes the view of the wound clear. We can see **how far** and **how deep** it reaches, find out the exact nature of the injury, and thus avoid such serious mistakes as sewing up a scalp wound under which there is a fracture or even an injury to the brain, caused by fragments of the bone or other foreign bodies being pushed into the brain substance. Every surgeon who commands any material of consequence has operated on a number of abscesses of the brain, caused in such a manner. The diagnostic question if large flaps can be saved must be answered in the most conservative way, as the unusually rich blood supply of the scalp makes reparation possible when you surely would get necrosis in other parts. We have still to mention **total scalping,** which in modern times is not effected by the Indian on the warpath, but by the belting in factories, when women with loose or braided hair get caught between the belting and the fly-wheel. These patients are carried around during several revolutions until the entire scalp, sometimes with the ears, is torn away.

Danger of sewing up wound prematurely.

I have had one personal experience in this line, where we succeeded by very early transplanting after Thiersch's method, not only in saving the girl, but in preventing any disfigurement. After the enormous defect had finally healed, a wig was the only abnormal part of the girl.

With the extensive use of electricity for power as well as light, severe electric burns of the scalp are of comparatively frequent occurrence, especially with linemen sent to repair broken wires heavily charged.

Burns by electricity show quite characteristic symptoms in so far as the redness of the usual burn, as well as blisters, are absent. The burn looks more like a **necrosis.** The first examination cannot possibly reveal or indicate how far the following necrosis, which is always very large, is to spread. This is the result of severe **endarteritic** changes, the arteries being better conductors of electricity than other tissues. Therefore dangerous late **hemorrhages** are commonly observed in these injuries. If the contact has been long, the necrosis goes deep, as, for instance, in the case shown in Plate 3, where, besides the extensive burn of the scalp, the outer layer of the skull became necrotic and was eventually removed. The fingers missing in the picture were burned black and crisp. A current of 2,750 volts passed through the body for ten minutes.

The most serious **complication** in the course of the wounds of the scalp is the diffuse **phlegmon.** It shows the characteristics of other

Phlegmons.

phlegmons, swelling, discharge of pus, tenderness, high temperature and pulse, but is especially to be dreaded for its course of spreading, which is nearly without limit according to the anatomical conditions, and because of the neighborhood of the most vital organ—the brain. They are of very frequent occurrence, and almost exclusively the result of improper treatment of wounds of the scalp, which often enough were quite simple at first. Every surgeon sees those phlegmons spreading under scalp wounds which have been sewed up. I therefore regret and protest against the viewpoint of von Bergmann, whose advice is to sew up all scalp wounds. I have made it a standing rule to leave them open even after most thorough disinfection, and rather run the risk of the inconvenience of retreating flaps than that of serious infection. This treatment surely constitutes the safer way for the general practitioner.

Injuries to the Bone.

Fracture of the base of the skull. If the **skull,** which is to be considered a hollow sphere of bone, with its elastic contents, is **compressed** beyond its elasticity, it **bursts.** The compression of that sphere may be produced by the force of a broad, blunt object, or more frequently by a fall of the patient on his head. The direction in which the patient falls, if forward, backward, or sideways, or the spot of the skull where he strikes, does not seem to be of any consequence. The **skull breaks** along any spheric line leading through the foramen occipitale, although the fracture follows with a certain predilection the fissures of the base of the skull connecting the different foramina which exist there. The places where those fractures reach the outer, visible surface of the skull are the **orbit,** the **nose,** and the **meatus** of the ear. The fracture is accompanied
Symptoms. by **hemorrhage,** and, frequently, flow of **cerebro-spinal fluid.** If, therefore, in one or several of the named orifices, oozing of blood or cerebral liquor is observed, a fracture of the base of the skull is highly probable. Bleeding from the nose is naturally the most unreliable symptom, as it will very easily occur in a heavy fall, especially if it should be forward. Sudden **exophthalmus** and **ecchymosis** make the diagnosis more probable, while **bleeding** and still more oozing of **cerebral fluid from the ear** is a sure symptom of a fissure into the auditory meatus, and of perforation of the drum. Wherever blood or liquor appears, escape of brain matter may be observed too.

Bleeding from the ear not produced by fracture of the base may

occur after a tear in the drum, after a fracture of the mastoid and the posterior wall of the meatus, without reaching the base of the skull, and after forcibly tearing apart the cartilaginous portion from the external meatus. Besides, one has to make sure, of course, in every case that the blood in the ear has not run in from a wound of another part of the skull. Differentiation.

Besides this appearance of flowing blood, mere **suggillations** of blood under the skin may indicate a fracture of the base. The places where we observe these are the eyelids, the conjunctiva, the mucous membrane of the pharynx, the region of the mastoid process, and the sides of the neck. The suggillation of the eyelid is the most unreliable symptom, of little more value than appearance of blood under the conjunctiva, while the appearance of **exophthalmus** immediately or shortly after the accident is an absolutely **reliable sign** of a **hemorrhage** from within, and therefore of a fracture of the base.

The **suggillation** of the mucous membrane of the **pharynx** is comparatively rare, and therefore of less importance.

The third group of symptoms is dependent upon **lesions of the nerves** which are situated at the base of the skull. Injury of nerves.

Injury to the **olfactory** nerve or bulb produces **loss of smell.** The injuries to the nerves are produced either at once by tearing or pressure of a fragment on the nerve, or the lesion shows itself later on if it is produced by slow pressure from a hemorrhage or is a neuritis.

The nerve most frequently affected is the **facialis.** In at least fifty per cent of the basal fractures **paresis** of the facial nerve occurs. A complete paralysis without reparation we find only if the nerve has been completely severed. The symptoms of the paresis of the facialis are so well known that they hardly need any description. The naso-labial fold is smoothed out, the corner of the mouth drops, and ptosis of the upper lid appears. If the patient is conscious, inability to whistle or to smack the lips confirms the diagnosis.

If the **acoustic nerve** is injured, **deafness** occurs; but this symptom alone is not to be regarded as reliable.

The injury of the **abducens** does not seem to occur so frequently as von Bergmann assumed; nevertheless, it has been observed in some cases.

The most serious symptoms of fractures of the base are not the result of the injury to the bone, but of the **injury to the brain.** In the further development of the case infection may occur through the three orifices named above, and thus produce the symptoms of **meningitis.**

Fractures of the Vault.

In contrast to the fractures of the base of the skull, fractures of the vault are usually produced by **direct force,** rarely by indirect force. We observe three forms of fracture, namely:

1. Fissures.
2. Comminuted fractures.
3. Fractures in the form of holes with loss of substance.

Fissures.

1. Fissures **usually penetrate** the thickness of the skull in its **three layers**—the outer and the inner tabula and the spongiosa between them. The injury may result in single or multiple cracks, which resemble the cracks in a lamp chimney. They may run in the direction of the blow or crosswise, and may affect one bone or more, and are not stopped by sutures of the skull, crossing them as if the two articulating bones were one. At the moment of the break the edges doubtless gape, as is proven by the hairs and other foreign bodies which we find sometimes wedged between them. One edge may be lower than the other, or even with it. Fissures occur either alone or combined with penetrating fractures of any kind.

Star fracture.

2. The **piece broken out** of the skull may be composed of one or a number of fragments. If there are several fragments, they may be arranged in their position toward each other in almost any way. The fact that they are sometimes arranged in the form of a star has led a number of surgeons to describe a separate form of **star fracture.**

Depressed fractures.

Much more important than the specific form of a comminuted fracture or the situation of its fragments, is the question whether they lie more or less in the spheric **surface** of the skull, or are **depressed** to any extent. The liability of fragments produced in comminuted fracture and such with loss of substance to become dislodged and displaced, is the most important diagnostic and prognostic point; if the power producing the fracture has not spent itself after the fracture has taken place, but continues, the **splinters are driven** into the tissues beneath it, namely, the **dura** and the **brain.** The form of depression may be manifold, but corresponds to a certain extent to the manner in which it has been produced. If a man falls with his head against a pointed stone, we most probably will find a **funnel-shaped depression;** if such is the case, the fragments of the inner tabula should stay in contact with each other and show only a number of cracks. On the inside of the skull the form may be roof-like or that of a pyramid with a certain number of sides.

3. The fractures in the form of a **hole**, with loss of substance, are usually the result of a **shot**, and either affect both tables equally, or, as is usual, the interna is broken out in a larger piece than the externa, or the interna is broken alone. This latter occurrence is not so rare as has been assumed formerly, and is analogous to the green-stick fracture of the long bones. If the velocity of the projectile is very high, as in the rifles with small calibre of new construction, an **explosion** of the **entire skull** takes place under certain circumstances.

The diagnosis of a fracture of the skull may be difficult or easy, according to the local symptoms.

Diagnosis of fractures.

The apparently simple non-compound fractures offer decidedly more difficulties than compound fractures, as the former cannot be seen, being hidden by the skin. We have to rely entirely upon our sense of touch to make out a **subcutaneous fracture** of the skull. It is obvious that a simple fissure with no depression will evade our examining finger, and only fractures with deformities can be thus diagnosed. To prevent mistakes we have to exclude:

1. The residua of deformities acquired during birth or by former injury.

2. Senile atrophy, which sometimes shows grooves with steep walls.

3. Defects and irregularities in the surface of the bone produced by **syphilitic ostitis**, which are quite frequent, and natural protuberances which vary with individuals and races, as, for instance, the bump at the point of the occipital bone.

We have mentioned before the possibility of mistaking a hæmatoma with its harder circumference for a depressed fracture.

The **general condition** does not help us much in the diagnosis of these fractures. It is true that most fractures are accompanied by **concussion of the brain**, but it is just as true that a great many concussions of the brain occur without fractures. If the fragments have been displaced deeply and entirely loosened, the diagnosis of a subcutaneous fracture becomes evident and certain, while otherwise a great many of these injuries are overlooked, even after very careful examination, guided by experience. This difficulty led surgeons of former times to change the subcutaneous into a compound fracture, to be able to explore the nature and extent of the injury. This has all been given up in modern surgery, the more conservative method being of immense advantage to the patients. If we decide to-day to operate for subcutaneous fracture, we do not operate for the fracture itself, but for the injury to the brain.

Difficulty in diagnosis.

Compound fractures.

A compound fracture is decidedly easier to diagnose. If we hold the edges of the wound in the scalp apart, we recognize the **fissure** by the blood oozing from it. If there are only grooves in the outer table and small defects, they are easily recognized as such. If there are fragments and splinters driven into the brain, we have no difficulty in finding this out. It is of importance not to overlook a **depressed fracture,** because elevation or, if necessary, removal of the depressed fragments is of prognostic importance; nevertheless, it is not advisable to do too much trying to explore, as our diagnostic examinations should be carried out only for therapeutic reasons, and we have to refrain from measures which would be of no value to the patient. If we have to remove fragments, the condition of the **dura,** which then comes into view, is of the highest importance, first if it is **penetrated or not,** and then if it shows **pulsation or not.** Wherever the dura is severed, brain matter will protrude.

Injuries to the Contents of the Skull.

1. Dura.
2. Pia.
3. Brain.

Dura.

1. While an injury to the dura probably never occurs without the inner parts, pia and brain, being affected at the same time, it has to be stated that it is the tear or cut in the dura that permits a hernia of the brain. The blood supply of the dura is very rich and of peculiar character, as a number of vessels enter the brain through the dura, the most important artery being the arteria meningea media.

Pia.

2. The **pia** is still more vascular, and some of the **vessels** may **tear** by blunt force without any wound being inflicted on the pia. If this is the case, a **subdural hæmatoma** is formed, which is of frequent occurrence. Operative interference, consisting of trepanning and evacuation of the hæmatoma, shows, if done at the right time, such good results that it is of the highest importance to diagnose these cases correctly and early enough.

The injuries to the pia producing hemorrhage under the dura on the brain are really in their effect injuries to the latter.

3. Injuries to the Brain.

(a) **Concussion of the brain.** To understand clinical symptoms, it is advisable to know their etiology. But strange to say, as well known and well established as is the clinical picture of concussion of the brain since Hippocrates' time, its explanation still differs greatly with different authors. Some assume that the symptoms are brought about by minimal ecchymosis-like hemorrhages throughout the entire brain. Others, von Bergmann with them, accept the theory based upon experimental research, that concussion of the brain can be produced by repeated small blows, instead of one heavy one, to exclude symptoms which do not belong to the concussion. This I cannot accept. At the request of my former chief, Professor Schede, I made a compilation of a hundred cases of trepanning of the mastoid to find out if any "hammering symptoms" had been observed (hammering symptoms produced by repeated blows with chisel and hammer on the brain, which had surely not been exposed to any mechanical insult before). I found that only two out of the hundred cases showed any remarks in the history about the "*Verhammerungs*" symptoms, in spite of the fact that Schede as well as his assistants had paid special attention to this point. **Concussion** must be therefore a momentary **disarrangement** of the **juxtaposition of the brain cells,** which is proved by the fact that in a number of cases of concussion of the brain which ended fatally, not the slightest visible change in the brain matter could be found. One of the criterions of concussion of the brain is that it is not a state which lasts any time. Its **quick passing** is **characteristic**—either the patient recovers quickly, or it leads to death. Only very few cases of concussion are recorded in which the symptoms lasted for several days, and then it is doubtful if they were not complicated with other lesions of the brain. We have to distinguish between slight and severe commotions. The **slight commotion** shows symptoms **similar to** the simple **faint** produced by anæmia of the brain. One symptom has to be mentioned, which occurs even after light concussions of the brain. The patients not only have a complete amnesia of the accident, but very often it comprises a longer or shorter time before the accident. This ante-accidental amnesia may disappear soon with the other symptoms, or persist for a while, or forever.

Explanation of concussion of the brain.

Amnesia.

(b) **Compression of the brain.** The brain is incompressible. This is proved beyond doubt. Besides, it is encapsuled in the perfectly stiff,

although elastic skull. If, therefore, the space which is allotted to the brain and its complements—the brain sac, the cerebro-spinal liquor, and the blood contained in the vessels of the brain and its adnexa—is narrowed by the introduction or growth of any foreign substance, the brain cannot give. The immediate result of this is that the brain itself compresses its own vessels, so that blood charged with oxygen cannot circulate freely. This produces:

Results of compression of brain.

1. **Slow pulse** of **high tension** caused by the affection of the vagus, which is first irritated and then paralyzed.

2. The **respiration** is affected in the same way. It becomes **deep, slow,** frequently **snoring.** The symptoms are those to be defined as a state of **excitation,** with headache, vomiting, restlessness, irrational speech, redness of the face, contraction of pupils, increase of blood pressure, slowing of the pulse. After this follows the state of **paralysis.** Unconsciousness changes into sopor and coma, Cheyne-Stokes breathing sets in, the pulse becomes fluttering, uncountable, which continues for one or several seconds even after respiration has stopped.

The most important symptom of **compression of the brain** is the **choked disc.** Every case in which we assume compression of the brain should therefore be carefully examined with the ophthalmoscope.

Causes of compression of brain.

Compression of the brain may be the result of:

1. Diminution of the capacity of the vault, as we see it in ostitis, osteoma, leontiasis, etc.

2. Increase of the cerebro-spinal liquor.

3. Foreign bodies penetrating into the brain.

4. Pathological formations, as hæmatomas, abscesses, and tumors.

It is important to find out by observation if the symptoms of pressure are increasing or decreasing. If they are increasing they will end fatally, while in the other case the patient will recover.

Early diagnosis important.

The early and correct diagnosis of compression of the brain is of great importance, as a number of **operations** come into question, some of which have been accomplished with great success. To alleviate the pressure exerted by increased cerebral liquor, **puncturing** the **ventricles** after trephining or **lumbar puncture** is performed. For other causes of compression, like endocranial hæmatoma, hemorrhage in the brain matter, and tumors and abscesses, **evacuation** of the compressing parts, by means of temporary resection of the skull, has been achieved with success.

Injuries to the Intracranial Vessels.

1. Arteria meningea media with its veins.
2. Sinus longitudinalis and sinus transversus.
3. The larger veins of the pia.
4. The cerebral carotid.

Of all the **intracranial vessels,** the **arteria meningea media** is by far the most important one as to the blood supply which it furnishes, as well as to the typical symptoms produced by an injury to it.

The artery may be injured either directly, by cut, thrust, shot, etc., or, as in most cases, by blunt force. In the latter case, a fragment of the fractured bone may pierce the artery, or the vessel tears at the time of the elastic expansion which the skull undergoes. Injury to artery.

But even if the vault has not been fractured at all, this tear of the artery may occur. If the artery is torn, a **hemorrhage** of course takes place as soon as the shock, which exerts a certain depressing influence on the vascular system, is overcome. If, as in most cases, the dura has not been severed, the hemorrhage is entirely **intracranial,** and to localize it more definitely, **extradural.** The hemorrhage lasts until a thrombosis of the artery is formed, or until the intracranial pressure equals the pressure in the artery, which is about from 80 to 100 mm. quicksilver.

If the extradural hæmatoma is circumscribed, it is mostly a **temporoparietal hæmatoma,** which corresponds about to the motor region of the underlying brain.

The **symptoms** are those of an increase of the intracranial volume, namely, **pressure.** Characteristic for this form of pressure on the brain is the so-called "free interval" after the first symptoms of the commotio cerebri, which is always connected with this injury, have subsided. The patient appears perfectly normal for a while, after which he loses consciousness again, becomes somnolent, etc., with all the other symptoms of compression of the brain, in regard to pulse, respiration, etc. "Free interval."

The **duration** of the **free interval** varies greatly. It may last from only a few hours up to three or four days. If it lasts longer, it indicates a subdural hæmatoma, of which I shall speak later on.

Typical and pathognomonic is the **contralateral hemiplegia** produced by pressure on the psychomotor centres. It is usually preceded by **convulsions,** but there are also cases on record in which instead of the contralateral, a **collateral hemiplegia** takes place, *i.e.*, where the paralysis corresponds with the side of the injury. Typical symptom.

Aphasia is rare.

The condition of the **pupils** is of uncertain value. The principal symptoms are, therefore:

1. Free interval.
2. Pulse of high tension.
3. Stertorous respiration.
4. The slowly developing hemiplegia.

Differential diagnosis.

For differential diagnostic purposes we have to exclude **commotio cerebri** pure and simple, acute alcoholic **intoxication,** and spontaneous **apoplexy,** then the late traumatic apoplexy and **fat embolism.** The diagnosis is of much importance, as the hemorrhage in most cases has to be stopped, and secondly, because the brain has to be relieved of the pressure. The exact localization of the hæmatoma is not of such importance (except the side on which it occurs), as the therapeutic measure is to be osteoplastic trephining.

2. **Injury to the sinus.** Only two sinuses are of importance in this regard—the **superior longitudinal** sinus and the **lateral** sinuses. As in the case of the meningeal artery, the injury may have been produced directly by a weapon or foreign body, or the sinus may be torn by blunt force. If the injury to the sinus is connected with a surface **wound,** the diagnosis can be made with certainty if an excessive **venous hemorrhage** occurs. If the hemorrhage is intracranial, the symptoms produced will be the same as in the arterial hemorrhage, only developing more slowly.

3. **Injuries to the vessels of the pia. Subdural hemorrhage.**

Subdural hæmatoma.

Subdural hemorrhage may be produced in the same two different ways as the other hemorrhages. It is claimed that the subdural hæmatomas have a tendency to form at the base of the brain, as there is nothing to interfere with the blood following the law of gravitation, but my own experience does not coincide with this presumption. The symptoms are very nearly the same as in the extradural hæmatoma, only the free interval seems to be longer. The only differential symptom is that the **aphasia** seems to be more frequent. I quote here one of my own cases:

Illustrative case.

A stone-mason wearing a derby was hit on the left side of the head by a brick falling from a height of sixty feet. He lost consciousness for a short while, and then walked home. After a few days' rest, during which he felt dizzy, he went back to work. No brain symptoms of any kind had developed. On the twenty-first day after the injury he was spending Saturday afternoon at home, when he tried to raise a cup of coffee to his mouth and found

that he could not direct it properly. Within an hour be became aphasic and paralyzed in the right arm and leg, and showed the complex symptoms of compression of the brain. He was transferred the same day to the hospital. His condition became gradually worse, so that he was practically unconscious—could be roused only with difficulty and did not recognize anybody. The paralysis of the right extremities became complete. The history of the case was not elicited until two days afterward when the diagnosis of subdural hæmatoma was made—this in spite of the fact that this diagnosis appeared very improbable, no case with such a long "free interval" being on record. A hemicraniotomy was performed, and I removed a blood cake about three-quarters of an inch in thickness, which extended over the entire left hemisphere of the brain. After replacement of the Wagner's flap, the wound was closed. As soon as the patient came out of the narcosis he regained consciousness. All the symptoms of compression of the brain disappeared within a few days, and the patient was dismissed from the hospital—cured—to take a position as stonecutter with a sculptor, where he need not work at dizzy heights.

Free interval of 21 days.

It is plain that in a great many cases it is impossible to differentiate an extradural hæmatoma from an intradural one, so that the necessary operation has to decide this diagnostic point. As soon as the diagnosis of intracranial hemorrhage is made, active surgical interference is to be advocated most strongly in fresh cases, as well as in cases which come under observation only after the lapse of a number of weeks.

Differentiation.

4. **Injuries to the cerebral carotid** are so rare, usually leading to death in such a short time, that it is sufficient to mention that the principal symptom is a **pulsating exophthalmus.**

SYMPTOMS OF INJURY TO

Arteria meningea media.	Sinus longitudinalis et transversus.	Pia.	Carotis cerebralis.
Arterial hemorrhage..	Venous hemorrhage.		
"Free interval".....	"Free interval".....	Longer "free interval."	Very rare.
Pulse of high tension.	Pulse of high tension.	Pulse of high tension.	
Stertorous respiration.	Stertorous respiration.	Stertorous respiration.	Pulsating exophthalmus.
Contralateral hemiplegia, developing slowly.	Contralateral hemiplegia, developing more slowly.	Contralateral hemiplegia.	
Aphasia rare	... .	Aphasia more frequent.	

Injuries to Intracranial Nerves.

The injuries to the intracranial nerves are mostly of diagnostic interest and of little practical value, except where the injury is indirect, as, for instance, by pressure exerted on a nerve by a blood extravasation. Most of these injuries occur with fractures of the base of the skull. The nerves most commonly affected are:

1. **Olfactory nerve.** The principal and only characteristic symptom of injury to the olfactory nerve is **anosmia,** which cannot be detected until the symptoms of concussion of the brain, etc., have subsided. If the faculty of smell is restored, its former loss was produced only by pressure from a hæmatoma. If the loss is permanent, the bulb has been torn through. The injury is **usually bilateral.** It may occur as the sole effect of an injury to the head, or combined with other paralysis.

Case. As an example of the former kind I may cite the case of a nurse of the German Hospital who suffered a fracture of the base of the skull from a fall backward off an electric car. After the symptoms of the concussion of the brain and the fracture had subsided, it came to observation that she had lost the sense of smell completely, which compelled the girl to give up her profession as trained nurse.

2. The **optic nerve** is very frequently affected in fractures of the base. Usually we find **hemorrhages** into the **sheath of the nerve,** although the continuity of the nerve may be interrupted entirely. The symptoms are accordingly: **sudden and lasting amaurosis** ensues, or compression of the nerve takes place which only appears after a certain time (after the hemorrhage has been established), and may then persist or disappear. The **ophthalmoscopic examination** will inform us of the existing conditions.

Other nerves of the eye. Injury to the **nervi oculomotorius, trochlearis,** and **abducens.** The **pupil dilated** ad maximum, **mydriasis,** and **ptosis,** are frequently the only signs of injury to the third nerve. The **trochlear** nerve is affected very rarely alone, while the **abducens** seems to be exposed more by its long course inside of the pars petrosa, which explains the comparative frequency of its injury.

4. The **trigeminus** is also injured very rarely alone, and is only important because anæsthesia of the trigeminus always produces a **keratitis neuroparalytica,** which is a decubital ulcer in the sense as described in the introduction.

5. The **facial nerve** is the most frequently affected by injuries, fully one-fifth of fractures of the base of the skull showing that symptom. The symptoms differ according to the spot where the nerve has been injured in its course through the Fallopian canal, and may show paralysis of all the facial muscles, or only very slight affection of some branches of the nerve. It is frequently combined with a lesion of the **acoustic** and **abducens** nerves. Injuries to other nerves are of less importance, as they occur extremely rarely.

DISEASES OF THE HEAD.

Diseases of the Soft Parts.

1. Swellings.
2. Neoplasms.
3. Inflammations.

1. The examination of the head of a patient has to inform us, first, if the **tumor** which we can see and feel is of intra- or extracranial origin.

Differentiation.

If the tumor is **not fixed** to the skull, it is surely **extracranial.** On the other hand, many tumors which are extracranial are fixed solidly to the bone. If we can reduce the tumor partly or entirely by pressure, it may be either an emphysema or a pneumatocele, or a vascular tumor, or it may be intracranial. If, after the compression or reduction, the surface of the bone feels perfectly smooth without any interruption, it is extracranial.

Pulsation proves that a tumor is in organic connection with the **blood-vessels** of the skull or its contents, **or** with the **liquor.** If pressure on the external vessels, the temporalis, occipitalis, etc., stops pulsation, the tumor is a formation belonging to the said arteries. If the effect is negative, the pulsation is due to cranial or intracranial vascularization. Intracranial tumors, besides, will of course show cerebral symptoms.

Emphysema of the head.

We describe now **emphysema** and pneumatocele of the head. The former occurs **after traumata** which have injured, without an outer wound, the cavities of the head containing air, especially the frontal sinus. The air enters between the meshes of the cutis and produces there the same physical phenomenon common to emphysemas of other parts of the body. The character of the **swelling** is somewhat different —**fluctuating and doughy.** On slight pressure we feel a **crackling** similar to the crunching noise produced by the foot walking over stiffly

frozen snow. The swelling, in spite of being circumscribed, can be displaced into the neighboring tissues or be pressed away entirely. Then the air escapes where it entered.

It is necessary to know this clinical picture, not to be frightened by its appearance; the emphysema is perfectly harmless and has, so far, always disappeared without any treatment whatever.

Pneumatocele of the head.

The pneumatocele owes its origin to a **defect** of the **bony wall** either of the frontal sinus or of the mastoid process. The air escapes then under the periosteum of the skull, and can be reduced by a procedure the opposite of Politzer's experiment. An emphysema as well as a pneumatocele can be increased if the patient closes his nostrils with his fingers and blows. While the emphysema is perfectly harmless, and usually lasts only for a very few days, the pneumatocele is according to its origin of lasting character, and may necessitate quite complicated surgical interference.

2. **Neoplasms.** The neoplasms of the scalp are, in their pathological order, as follows:

1. Lipoma.
2. Fibroma, of which we have the following subdivisions:
   (*a*) Fibroma molluscum.
   (*b*) Pigmented nævus.
   (*c*) The branched neuroma (*Rankenneurom*).
   (*d*) Elephantiasis.
3. Hæmangioma simplex.
4. Hæmangioma cavernosum.
5. Hæmangioma racemosum.
6. Aneurisms.
7. Sarcoma.
8. Atheroma, or sebaceous cyst.
9. Dermoids.
10. Carcinoma.

Lipoma.

1. Lipoma is comparatively rare. Usually located on the **forehead,** or sometimes at the lower part of the **occiput,** it really belongs more to the neck than to the head. The lipomas of the forehead always lie under the epicranial muscle, and thus may produce the deception as if they were surrounded by a hard bony wall (the same symptom we have found with hæmatoma of the scalp). Their form is **hemispherical or flat,** very rarely they are pedicled. The **skin** over the lipoma is unchanged and movable, and may even be picked up in folds. The sur-

face of the tumor itself need not be composed of lobules, as lipomas usually are, but may be perfectly smooth. They may be very **deceptive as to fluctuation,** a fact which easily may lead us to mistake them for atheromas. The **atheroma** with its covering skin can always be moved freely on the bony surface—the lipoma hardly ever. The lipoma is differentiated from the dermoid by their different places of predilection and the age of the patient when the growth appears, the dermoid being congenital. Differentiation.

A formation which occurs very frequently in poorly nourished infants with tuberculous diathesis is the **chronic tuberculous abscess of the bone** on the forehead. This may be mistaken for lipoma, but the tuberculous affection is rarely solitary, and shows in its later development changes of the surface of the skin, besides the fact that we have other signs of a tuberculous condition. In the same way we have to exclude a gumma.

2. The growths of the type belonging to the **connective tissue** usually show a soft, circumscribed, or diffuse character. They are of special interest as they seem to follow the course of the nerves. Forms of fibroma.

(*a*) **Fibroma molluscum** usually affects the entire body more or less. Numerous lobules from the size of a pea to the size of a fist and larger, grow on almost any part of the skin following the course of the cutaneous nerves. They grow from the nerve sheaths.

(*b*) The **pigmented nævus** is, microscopically at least, of the same character and is easy to recognize by its color and flat form.

(*c*) The **branched neuroma** usually assumes the form of a convolute, composed of racemose cylindrical or spindle-form and lumpy, thickened cords.

(*d*) **Neuromatous elephantiasis** is always **congenital** and usually combined with the same affection of other parts of the body. Of these affections just mentioned, only the racemose neuroma and elephantiasis are of surgical importance, as they usually need operation.

(*e*) **Teleangiectasia**, or simple nævus, is more frequent on the face than on the head; nevertheless, it is not very rare. It shows, as is well known, the **form** of a **flame or map**, is usually of dark bluish-red color, and surrounded by a few isolated spots of the same character. Pressure always diminishes the size of the flat tumor. Many of the large, flat teleangiectasias of pale color disappear without any treatment.

3. The **hæmangiomas**, even of simple character, are of some impor- Hæmangiomas.

tance. If situated immediately above the fontanels special care is to be exerted in their treatment.

4. **Hæmangioma cavernosum** consists of a number of vessels of equal calibre meshed together, but the single branches are really caverns constituting an irregular, spongy mass. To recognize them as such is important, as any attempt to treat them with the knife would lead to considerable difficulty. The thermocautery answers the purpose much better.

5. The **racemose arterial hæmangiomas** affect the **scalp,** especially in the occipital part, very frequently. Most of them are of **traumatic origin** and formed by a number of arterial aneurisms. Besides the occipital and auricular artery, the frontal and superficial temporal arteries are frequently affected. The swelling is flat, and does not protrude much. It is pulsating through its entire surface, and it is significant that compression of one, or even two, of the principal vessels frequently does not stop pulsation. The greatest danger connected with them is **spontaneous rupture,** which in most cases rapidly leads to death. It is necessary to know that this affection is a **very serious** one, because its extension is much larger than one would suppose. Usually the vessels of the skull, and even intracranial arteries are affected at the same time. Only very energetic, early operations promise any result.

Aneurisms.

6. The **plain arterial aneurisms** are easy to recognize, and usually belong to the region of the superficial temporal artery. They are the result of an injury which penetrated the artery partly or totally.

The **arteriovenous aneurisms** are the result of wounds by thrust or cut. A peculiar and very loud **humming** establishes the diagnosis without difficulty. Pressure on the junction of the vein and artery stops pulsation at once.

Sarcoma.

7. The **sarcomas** of the scalp are **rare.** Their diagnosis usually cannot be established beyond doubt until a **microscopical examination** of the excised portion has been made. The prognosis is very infaust. A special form of these sarcomas is the pulsating sarcoma, which, however, is exceedingly rare.

Epithelial tumors.

8. **Atheromas** occur very **frequently** in the scalp, which is the site of predilection for them. They may be either single or multiple. They seem to run in certain families. They form complete spheres composed of a sac filled with epithelial cells. This form may be influenced by the pressure exerted on them against the skull, which results in their being flattened out. The top of the tumors very frequently shows a comedo,

a fine canal (which may be occluded) leading into the cavity. They vary from the **size** of a grain of millet to that of a fist and more. The smaller the tumor, the harder it is, the bigger, the softer. The **doughy consistency** either gives the feeling of kneading clay, or, if more fluid, that of fluctuation. The differential diagnosis of the atheromas does not offer any difficulties if the examination is carried out properly. Their early recognition and, if possible, removal is of great importance, as they have a tendency to ulcerate, which, besides being disagreeable and unsightly, may give rise to phlegmon and erysipelas of the scalp.

9. The **dermoids** come under observation from the second to the fourteenth year, in contrast to the atheromas, which usually appear in later life. They are always **cougenital,** and usually in such close connection with the periosteum that very frequently a part of the same has to be extirpated with the tumor. Very commonly they are found at the **supraorbital margin,** and offer, even if small, some slight difficulty in their extirpation by their dense adherence. If the **orbital dermoids** achieve any considerable size, they may bring about **exophthalmus,** and may then offer some difficulty in differential diagnosis, all the more as this is the seat of predilection for sarcomas.

10. The **carcinomas** of the soft parts of the skull belong histologically to the epithelial layer of the skin and follicles. They have a great tendency toward ulceration and may then be recognized as such.

3. Inflammation.

Erysipelas and **phlegmon.** As I have mentioned before, Fehleisen's streptococcus erysipelatis is, as far as we can decide to-day, in every respect identical with pus streptococcus found in deeper layers of tissue. This explains why this specific inflammation of the surface of the skin is so frequently connected with phlegmons of deeper layers. The erysipelas of the head corresponds with that of other portions of the body, except that the unusually rich blood supply of the scalp facilitates migration of the erysipelas to a vast extent. The much-dreaded **meningitis** in concurrence with erysipelas seems to be mostly a **myth.** While it seems plausible that an infection should wander through some of the many holes connecting the inner part of the skull with the outer, it seems that good observers do not encounter true meningitis in connection with erysipelas. Where such a condition was suspected, it may be that the somnolence and other symptoms of high fever and general

Erysipelas often combined with phlegmons.

prostration were mistaken for meningeal symptoms. The phlegmons of the head are always considered as especially dangerous, while they really do not offer any more difficulties than phlegmons of the sheath of a tendon, for instance. Appropriate measures at the start of the disease are well able to check the same.

Neoplasms of the Scalp.

Tumor.	Frequency.	Locality.	Nature.	Age.
Lipoma	Rare	Forehead and occiput.	Hemispherical or flat, lobular or smooth; immovable on bone; skin unchanged and movable.	
Fibroma molluscum.		Entire body...	Lobules from the size of a pea to a fist.	
Branched neuroma		Entire body...	Convolute form	Congenital.
Nævus	Not rare...	Face	Flame-like form, dark-bluish-red color.	
Hæmangioma cavernosum.			Vessels meshed together, forming caverns in an irregular spongy mass.	
Table. Hæmangioma racemosum.		Scalp	Flat, pulsating swelling.	
Aneurism			Humming sound.	
Sarcoma	Rare	Supra-orbital margin.	Very rarely pulsating, determined by microscope.	
Atheroma	Most frequent of all tumors.	Scalp	Spherical or flattened; size from millet-seed to a fist. If small, hard; if bigger, softer; doughy or fluctuating.	Later life.
Dermoids		Supra-orbital margin.	Adherent to periosteum.	Congenital, second to fourteenth year.
Carcinoma			Generally ulcerating.	

Diseases of the Skull.

(*a*) Rickets.
(*b*) Osteomalacia.
(*c*) Tumors.
(*d*) Syphilis.
(*e*) Tuberculosis.
(*f*) Acute Osteomyelitis.

(*a*) **Rickets.** This disease and the changes which it produces in the bones and the formation of the skull, occur mostly before the fourth month of the new-born. Its principal symptoms are the **softening** of the parts of the bone adjacent to the sutures, and the occurrence of circumscribed soft areas in the occiput. The **great fontanel** always **gapes** widely, and does not close until the third year and even later, while under normal conditions the fontanels are closed before the fifteenth month. This soft occiput has given to this disease the name of **craniotabes.** The softer the occiput the flatter it gets. This, and the thickening of the parietal and frontal bones, produces the **square head** so characteristic for the rickets of the skull. Some parts of the occiput are so soft that they can be bent inward by a slight pressure with the finger, like a card, to snap back as soon as the pressure is relieved.

Changes in the bones in rickets.

The children are restless, start up suddenly in their sleep, and show profuse sweating of the head lying on the pillows, while the other parts of the skin seem to be dry and hot. The head gets very tender, so that the babies do not want to lie down, but sit up. The dentition is slow and irregular.

Craniotabes has to be **differentiated** from **congenital hydrocephalus.** While the softness and elasticity of the edges of the bone are common to both, there is no increase in the dimensions of the skull of rickety children in contrast to the generally enlarged head of hydrocephalus.

Differentiation.

In the third year the symptoms of craniotabes disappear, and the change in the formation of bone characteristic for rickets takes place. The hardening follows the softening.

(*b*) In **osteomalacia** the bone is exceedingly soft, but thickened. The occiput protrudes and the skull shows a **characteristic asymmetric form** because one side is usually more affected than the other. On the outer surface of the skull we feel unevenness and irregular lumps. In all cases other bones are affected too, especially the lower extremities, which makes the patients strikingly short—the more so as they show a kyphotic curvature of the spine.

Senile atrophy of the bone in persons of advanced age calls for brief mention. The wasting away affects the inner table wherever the shape of the skull remains unchanged. This state usually does not come to observation until some accident shows how thin the bones are.

Senile atrophy.

(*c*) **Tumors.**

1. Osteoma.
2. Leontiasis.

3. Echinococcus.

4. Sarcoma.

Osteoma.

1. The **exostoses** of the skull occur most frequently on the **frontal** and **parietal bones.** They vary from the size of a pea to that of an orange. Those of the outer surface of the bone are smooth, while those of the inner side of the skull show protuberances. Their traumatic origin has been frequently asserted, a fact which concurs with a number of my own observations. Of special interest are the encapsulated osteomata occurring in the orbital or frontal sinus. They usually do not occur before the fourteenth year, and can be recognized by their very slow growth and the local symptoms which they produce, according to their seat.

2. The **osseous leontiasis** is a chronic inflammation of the bone, producing a hypertrophy of the tissue parallel to the inflammation of connective tissue in elephantiasis. Its etiology is entirely unknown, neither syphilis nor traumata being responsible as etiological factors. It is characteristic that the disease begins very slowly in one bone, and escapes notice frequently for a long while. No pain, no functional disorder. Finally a thickening of the bone is observed by the patient. Then more serious symptoms set in, as **exophthalmus,** followed **by amaurosis.** The **meatus of the nose** closes up and breathing is interfered with. The **sense of smell** is lost. Headache, neuralgia, convulsions, paralysis finally close the clinical picture. As all those symptoms develop very slowly, the disease covers a long number of years.

This characteristic impression cannot be mistaken for anything else if well developed. The lack of keratitis, iritis, ozæna, and other luetic symptoms differentiates it clearly from syphilis.

Echinococcus.

3. The **echinococcus** affects usually the **frontal bone,** and forms a big sac between the two plates of the skull. Young individuals are usually affected. The disease develops very slowly and can probably be diagnosed with certainty only after the formation of a fistula, which permits of the escape of the characteristic fluid, a microscopical examination of which shows the hooks. The disease, though rare, is of some importance, as surgical interference offers good results.

Sarcoma of the bone.

4. The **sarcomas of the skull** start from either the periosteum or the marrow of the bone, and are then either **peripheric or central.** Their etiology is as unknown as that of other sarcomas. They usually grow fast and end fatally by lesion of the brain and the formation of metastases in other parts of the body. The symptoms of the **sarcomas of the**

dura, if they perforate, are so similar to those of the bone that they have to be described together. They consist of the local symptoms of a tumor of the skull, then of the increasing growth of the tumor, and of the brain symptoms. The progress of a sarcoma of the dura produces **symptoms of compression of the brain** until it perforates outward, then the symptoms usually decrease and the tumor shows a typical condition, namely, **pulsation,** which is projected from the pulsation of the brain. Sarcomas of the dura.

(*d*) **Syphilis.** Hereditary syphilis of the skull seems to be **extremely rare,** if observed at all.

Acquired syphilis of the skull belongs to the late localizations of this disease. It affects either the periosteum or the marrow of the diploë.

Periostitis is the most frequent and mildest form of luetic affection of the skull, and usually occurs on the **frontal part** of the head. The tophus grows until in some cases suppuration sets in with all its characteristic signs of the luetic ulcer.

If the **bone** itself is affected, small perforations occur which finally join, and thus form an irregular hole as if eaten out. This destroying affection may involve quite a large area of the bone. The **necrosis** with its sometimes enormous destruction may entirely recede on its own account, and practically complete restoration take place. In other cases we find formation of pus with its sequelæ. The **diagnosis** of this affection can be very frequently **verified** by the wholesome effect brought about by energetic **antiluetic treatment.** If thus it has been established beyond doubt, very frequently most energetic surgical interference is strongly indicated. As soon as sequestra have formed, they need removal by operation. Syphilis of the bone.

(*e*) **Tuberculosis.** It is necessary to know the clinical picture of tuberculosis of the skull, although it is **not very frequent.** A definite diagnosis, of course, can be made only after **tubercle bacilli** have been found in the secretions or granulations. The seat of the affection is either a flat bone or the mastoid process, the latter being by far the more frequent. The tuberculosis may be either circumscribed or diffuse; in all cases the perforation of the bone is complete, and thus the tuberculous productions are to be found on, in, and under the bone—the cheesy decay, and shiny, glassy granulations, and pus with its suspended crumb-like particles. If an abscess on the frontal or parietal bone is formed, it quite frequently appears as a large-sized swelling covered with flabby bluish-red skin. Tuberculosis.

The diagnosis of this affection is of importance, as it demands free opening and scraping like other tuberculous affections.

(*f*) **Acute osteomyelitis** of the skull is an **infectious disease** due to the invasion of the staphylococcus pyogenes aureus and albus, as the osteomyelitis of any other bone. It is characteristic that it seems to develop spontaneously, *i.e.*, the point of entrance of infection, as a scratch on the head, is usually overlooked. Suddenly the temperature rises to 104° F. or thereabouts, with a chill, and we have a pronounced picture of an acute infectious disease. Further on, the formation of an abscess takes place, and eventually endocranial complications and necrosis of the bone. The more remote symptoms of the late period can be avoided by an operation based on a correct, early diagnosis.

The **differential diagnosis** between osteomyelitis, tuberculosis, and syphilis does not offer any real difficulties owing to the acute, violent character of the former disease.

Diseases of the Tegument of the Brain and its Vessels.

Cephalocele.

Among the **congenital surgical diseases,** we have cephalocele and hydrocephalus. Cephaloceles are tumors of the outer region of the head, covered by skin and connected with the inner contents of the skull by a defect of the same. They are to be compared with spina bifida. Their diagnosis is easy, as they are always congenital and have typical places where they occur, namely, either they are nasofrontal, naso-orbital, naso-ethmoidal, or they form a cephalocele occipitalis, either superior or inferior. The exact diagnosis includes, of course, the indication for operation. In most cases surgical interference is of no value, while in some complete removal of the cephalocele with its brain contents can be carried out.

Hydrocephalus.

The **congenital hydrocephalus** is absolutely typical and a picture by itself. It is produced by a progressing **increase of fluid** in the lateral third and fourth **ventricles,** which necessitates an enormous expansion of the head. The normal **measurements** of the head of the new-born are: fourteen inches in its periphery, five inches in its fronto-occipital diameter, and four inches in its biparietal diameter. Any numbers exceeding these measurements just mentioned, and a rapid increase of the same, justify the suspicion of a hydrocephalus. The appearance of such a head is so typical that it cannot be mistaken for anything else.

All the diameters of the vault are **equally enlarged,** and the cranium

MENINGOCELE IN A CHILD A YEAR OLD.

Note protruding upper jaw. Outline of the meningocele indicates the defect of the skull.

looks like a big ball set on a face, small, all out of proportion. The head becomes so heavy that the child one year old cannot lift it. **Nystagmus** and irregular **strabismus** are quite frequent. Differential diagnosis has to consider rickets, with which it might possibly be confounded, but the fact that in the latter no increase of the volume of the skull is observed, while the hydrocephalus head does grow to immense dimensions, should not make it difficult to keep the two affections apart. The diagnosis is of comparatively little practical value, as operations for hydrocephalus so far show very little result; the most approved treatment being puncture of the skull as well as of the spine.

Differentiation from rickets.

Acquired Diseases of the Teguments and Vessels of the Brain.

Phlebitis and **thrombosis** of the **sinus** occur most frequently in connection with **inflammation of the middle ear** and the **mastoid process.** In these cases the **transverse** sinus is attacked. There are a number of other etiological factors for phlebitis and thrombosis of the sinuses, which are identical with the causes of any phlebitis, as **marastic** conditions after exhausting diseases, or the progressing of inflammatory or **neoplastic** processes. The inflammatory thromboses are found in the neighborhood of the **primary focus;** thus the affections of the ear attack the transverse sinus; those of the **orbita,** the **cavernous** sinus.

Sinus thrombosis.

The thromboses of the **transverse sinus** in connection with diseases of the ear very frequently are carried on into the **internal jugular vein.** The thrombosis quite frequently decays, and then a further progress of the inflammation on the **meninges,** or the **brain,** ensues. In these cases it is possible that phlebitis, thrombosis, meningitis, and abscess of the brain in the parietal lobe, even with secondary **abscess of the cerebellum,** may exist together and complicate the diagnosis; but if one or all of these conditions exist, the indication for **operation** is the same. The earlier it is done the better.

The **general** symptoms are: high temperature (in some cases extremely high), high pulse, single or double choked disc, vomiting, profuse diarrhœa, irregular, sudden drop of temperature with profuse perspiration. The **local** symptoms of thrombosis of the **transverse** sinus are **œdema** and tenderness of the mastoid process, **pain** on tapping the skull, and symptomatic wry-neck. The patients hold the head inclined toward the **affected** side, complain of severe pain in the neck; pressure on the jugular vein excites pain, and sometimes the thrombosed

Symptoms.

vein can even be felt. The voluntary turning of the head is impossible, and passive motion very painful.

Thrombosis of the **cavernous** sinus usually shows **exophthalmus** and **œdema of the eyelids,** and **cyanosis** of the skin of the forehead.

The diagnosis is probable if any of the above-named symptoms set in, while chronic or acute **suppuration** of the **middle ear** exists. The symptoms may develop very rapidly and careful watching is essential. The affection of the mastoid cells is clearly a surgical disease, and many thromboses or abscesses of the brain might be avoided if these cases would come early under the observation of surgeons, and not of so-called ear specialists.

Differential diagnosis.

The differential diagnosis has to take into consideration other inflammatory processes along the sternocleidomastoid, as acute **inflammation** of glands, subfascial **abscesses**, **caries** of the spine, etc. The exact differentiation of the affection of the sinus from local or diffuse **meningitis**, extra- or subdural abscesses, or brain abscesses may be very difficult; but as they require the same operation, it is not so very important except for the prognosis. (Abscesses of the brain, as I will show later on, are abscesses surrounded entirely by brain matter.) The exact **extent** of the affection very frequently can be established only during the operation,—one of the cases in which the general diagnosis, with the indication for surgical interference, has to suffice, and the detailed facts cannot be learned until we operate. The **thrombosis** of the **jugular vein** must not be overlooked, as an effective draining of the mastoid region can be effected through the canal of the vein after the thrombus has been removed (in several of my own cases a cure has thus been achieved). There are practically no contraindications for the operation, as these cases are hopelessly lost without it, and the operation thus furnishes the only chance.

Tubercular meningitis.

Tubercular meningitis is always a **secondary** disease, mostly affecting children. For diagnostic purposes, therefore, the existence of tuberculous affection of another organ is of importance. The **symptoms** are the **same** as those of any other **meningitis,** and the exact nature of the inflammation cannot be ascertained until tubercle bacilli have been found in the fluid extracted by lumbar puncture.

Symptoms.

The patients, if not too young, first complain of **headaches** and general indisposition. After a short while **stiffness of the neck** develops, **hyperæsthesia** of the skin, difference of the pupils, photophobia, convulsions, vomiting, and slow pulse. If the patients are children, they

suddenly **cry out** in their somnolent condition in a very characteristic way. The sound is somewhat similar to a cat's call. **Constipation** usually exists, and the belly is drawn in and stiff. Trousseau's spots appear, also Kernig's symptom (the legs cannot be extended in sitting posture).

Differential diagnosis has to consider **typhoid,** where the symptoms of the sensory system may imitate a meningitis; but Widal's reaction sets this point clear. The differentiation from **tumor** or **abscess,** and **hemorrhage** of the brain may sometimes be very difficult, but is helped to a great extent by a lumbar puncture. The diagnosis is most important for its prognostic value, as the disease always ends **fatally.** The only possible operation is lumbar puncture, which relieves only the symptoms. There is no case on record in which operative interference saved the patient's life. Differential diagnosis.

Acute leptomeningitis of **non-tubercular origin** shows the very same symptoms as described above. The **prognosis** is decidedly **better.** In regard to differential diagnosis, one must note that besides other acute inflammatory diseases, **osteomyelitis** not infrequently causes an acute irritation of the meninges, which gives the clinical picture of meningitis, but which, even in most severe cases, nearly always recedes spontaneously. Leptomeningitis.

DISEASES OF THE BRAIN.

Commotion, cf. **Injury.**

Inflammation.

Inflammation of the brain is either of **traumatic** origin, where the infection takes place from an outer **wound,** or occurs as the sequel of a **meningitis,** which is carried on into the brain matter. As it is usually connected with meningitis, its specific symptoms are rarely seen. If a diagnosis can be made, it is of more scientific than practical value.

Tumors of the Brain.

The diagnosis of tumors of the brain sometimes presents difficulties enough to the experienced neurologist and brain surgeon, not to speak of the general practitioner, who very rarely gets a chance to familiarize himself with this clinical picture; nevertheless, it is necessary to know the symptoms of the comparatively more frequent types of brain tumor,

Probable diagnosis sufficient.

as those cases usually come to the observation of the practitioner first. It is sufficient if he makes a probable diagnosis of brain tumor, or even has a suspicion that he has to deal with one. For definite diagnosis of a tumor and its localization, the practitioner will have to rely on the advice of others, who have the opportunity to see those cases more frequently. They also have to decide about the advisability of operative interference. Luckily the symptoms of those tumors which show the best results for operation are most clearly defined, namely, the tumors affecting the so-called **motor region.** It is of course impossible for anybody to decide if the growth responsible for the symptoms belongs to the brain matter itself, or has started from the dura or the bone, and then has grown into the brain; but as this is of no consequence in regard to the operation, it does not matter much. The symptoms of a brain tumor are twofold:

1. General.
2. Local or focal symptoms.

General symptoms.

1. General symptoms comprise those described under Compression of the Brain—especially severe **headaches** and **double choked disc.** The **pain** is of a deep, dull, piercing character, accompanied by nausea and vomiting. Any excitement which produces rush of blood to the head increases the headache. The vomiting occurs without retching and with empty stomach. Its character is projectile. This form of vomiting is called **cerebral vomiting.** The other most important general symptom is the double choked disc, which may lead later on to atrophy of the optic nerve. Besides these two we observe other characteristics, but of less value, namely, sleepiness, drowsiness (the patients answer very slowly to questions put to them), general convulsions, vertigo, vomiting, slow pulse, and transitory loss of consciousness.

All these **general** symptoms are the result of **pressure** exerted on the **entire brain** by the presence of a foreign mass. If we had no other symptoms we hardly ever could operate, as we would not know where to suspect and find the tumor; but—

2. A number of tumors show besides these above-described general characteristics, local symptoms, owing to the fact that a certain **locally circumscribed part** of the brain has become diseased and disturbed in its function.

Topography of the brain.

It is important to know the **situation** of the different **centres** on the surface of the brain, and I therefore show an illustration where the principal centres which are of interest, can be seen. Most important

for us is the region of the brain bounding the **sulcus centralis** (fissure of Rolando), which comprises the **centres of the head, face, arm,** and **leg.** It is characteristic that **cramps,** which are **clonic,** start in a certain

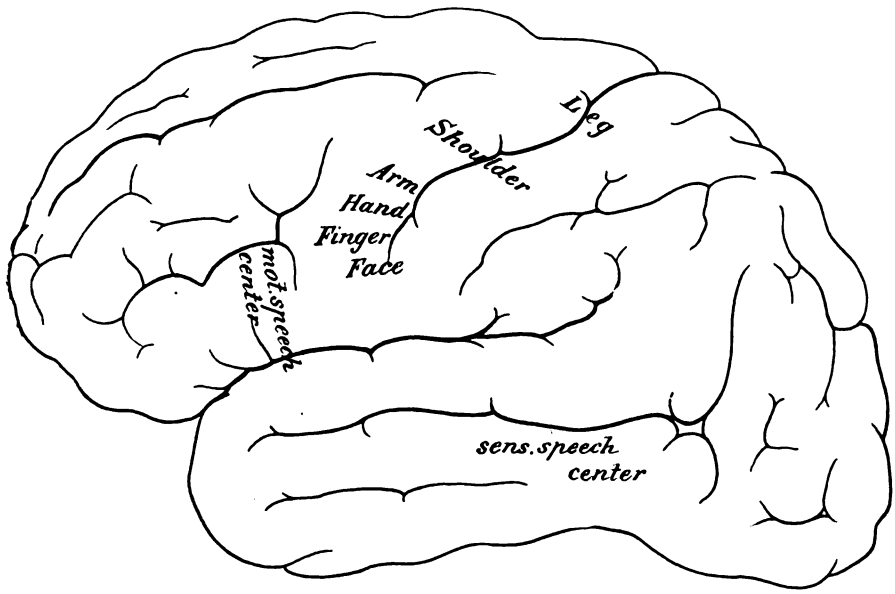


FIG. 4.—Motor centres of the brain (after Oppenheim).

part of the affected nerve region, and do not affect the entire nerve at once; thus, for instance, only the thumb, toe, or eyelid twitches. **Later** on the cramps may affect the entire nerve region, or may even become **general.** This progressing nature can be observed in each single attack of cramps, as well as in the further development of the disease. The **excitation** of the nerves affected is **followed** later on by **paralysis** of the same, and this is the case in all affections of the nervous system. It takes place in the same order in which the nerve centres were first affected. If the **tumor** is **situated** on the **left side,** the affection of the **speech centre** shows itself in **sensory aphasia.** This becomes reversed when we have to deal with a left-handed person.

Progressive nature of cramps.

In a general way we have to mention that all the **symptoms** described will **increase** with the **growth of the tumor,** and the cramps will grow more frequent and severe. Only tumors that can be strictly localized are of surgical importance. Even the most skilfully executed trephining, according to the most modern methods, is such a serious operation

that probatory opening of the skull (analogous to exploratory laparotomy) is strongly contraindicated, as well as the removal of a larger surface of the cortex, where the seat of the probable tumor could not be located with absolute certainty. Other symptoms are local **sensitiveness on tapping** a certain part of the skull, which is **combined** with the above-described distinctly localized, severe **headache**, further tumor-like bulging of the skull at the affected part, and the "*bruit de pot fêlé*," the sound of a cracked pot. This sound, which has been described as an important symptom by several observers, can be more readily detected in children, while grown patients apparently show it only after the bone has been affected by either pressure or growth.

Differential diagnosis.

The differential diagnosis of a tumor becomes the less difficult the more pronounced the symptoms are. As long as we have general symptoms only, a number of other diseases may be mistaken for a tumor. If we can prove the choked disc, a great many other affections will be excluded. If we finally get continuous headache and sensorial drowsiness, only a few other diseases are to be considered. The most important of these are:

1. Conglomerate brain tubercle.
2. Gummy formations produced by syphilis.
3. Circumscribed encephalitic softening.
4. Thrombosis or phlebitis of the sinus.
5. Acquired hydrocephalus.
6. Progressive paralysis.
7. Common epilepsy.
8. Jacksonian epilepsy.
9. Uræmia.
10. Multiple sclerosis.

The differential points are found in the table below:

Tumors of the Brain.

General symptoms.	Very severe headache, distinctly localized.		Of greatest importance.
	Single or double choked disc.		
	Sleepiness, drowsiness.	Hiccoughing.	
	Convulsions.	Yawning.	
	Vertigo.	Hyperæsthesia or hemianæsthesia.	
	Projectile vomiting.		
	Slow pulse.	Slow speech.	
	Disturbance of sensorium and intelligence.		
	General loss of flesh and strength.		
	Temporary loss of consciousness.		
	Dull facial expression.		

Local symptoms.
- Localized headache.
- Tumor-like protuberance of skull.
- Sound of cracked pot (bruit de pot fêlé).

Table of Localization.

Central convolutions.
- Typical attacks of motor Jacksonian epilepsy (after aura, cramps attack exclusively or principally one-half of body, and run their course in a certain constant order).
- Nature of cramps, first clonic, then tonic.
- If cramps are limited to one side, sensorium free; if bilateral, loss of consciousness.
- Symptoms of paralysis, first transient, later permanent; monoplegia; later, hemiplegia.
- Cramps begin in paralyzed groups of muscles.
- Disturbance of tactile and stereognostic senses.
- Motor aphasia.

Frontal lobe.

Left third convolution:
- Motor aphasia, beginning early, but developing slowly.

Other convolutions:
- No characteristic local symptoms.
- Frequently disturbance of equilibrium in standing and walking, as in cerebellar tumor.
- Staggering gait.
- Marked mental impairment.
- Abnormal attempts at wit.
- Disturbances of smell.
- Choked disc appears late, frequently unilateral, later weakness of muscles of trunk.
- Torsion of head toward one side, with opisthotonus.
- Sensitiveness on tapping, sometimes tympany.

Temporal lobe.
- Soul deafness, or amnestic (sensory) aphasia.
- Hemianopsia.
- Hemianæsthesia.
- Hemiparesis (in later course).

Occipital lobe (left).
- Soul blindness; homonymous hemianopsia.
- Alexia.
- Optic aphasia.

Cerebellum.
- Vertigo, characteristic.
- Objects seem to revolve.
- Headache nearly constant.
- Vomiting in seventy per cent.
- Optic neuritis in seventy per cent.
- Ataxia most important symptom.
- Gait is irregular and staggering, often zig-zagging.
- Patients sway as if drunk.
- In recumbent position, coördination tolerably good.
- Paresis of muscles of trunk.

It should be stated that there may be no symptoms whatever, if the tumor is in one hemisphere only, and does not involve the middle lobe, the cerebellum being functionally homogeneous. An entire hemisphere has been found absent and even extensive bilateral disease, without producing any symptoms during life.

Differential Diagnosis.

1. The **conglomerate brain tubercle** is probable if tuberculous affections are found in other parts of the body.

2. The **gummy formations produced by syphilis** are probable if other syphilitic processes are present.

3. The **circumscribed encephalitic softening** is probable with a history of apoplexy.

4. **Thrombosis or phlebitis of the sinus** develops after suppurative disease of the middle ear.

5. **Acquired hydrocephalus** is characterized by the excessive size of the head.

6. **Progressive paralysis** (etiological factor, syphilitic infection) shows the following symptoms: stumbling over syllables, literal ataxia, paraphasia (persistent repetition of same word), weak, rough voice, typical handwriting (first, motor disturbance, later, parts of words dropped, finally, wholly illegible); unequal pupils, delusions.

7. **Common epilepsy** is characterized by complete loss of consciousness, dilatation of pupils, not reacting, biting of tongue, convulsions lasting a few minutes.

8. **Jacksonian epilepsy** shows a history of trauma, depression of skull, or scars on the trunk and extremities.

9. **Uræmia** shows headache, vomiting and slow pulse, but other symptoms of nephritis, and casts.

10. **Multiple sclerosis** is characterized by absence of choked disc, absence of long-continued headache, absence of tenderness of skull on percussion; presence of marked spinal symptoms.

Another **aid to diagnosis** seems to have been found in the **Roentgen rays,** although so far only three cases have been reported in which tumors of the brain have been successfully radiographed—one by Church, one by Mills, and one by Jacoby and myself.

Operation. As the question when a tumor of the brain becomes a surgical case is usually decided by the practitioner, it may be well to describe the indications for operation. They vary according to the intention of the

operation, whether an entire removal of the tumor is contemplated, or only an alleviating operation for the most urgent and dangerous symptoms—the first being the only real, strict indication to be followed after ascertaining beyond doubt the existence of a tumor. Besides, its location must be such that it can be reached with the knife. This condition is fulfilled in decreasing order as follows:

1. By the tumors in the region of the central convolutions.
2. Speech centre.
3. Frontal lobe.
4. Occipital lobe.
5. Parietal lobes.
6. Cerebellum.

We thus find, as stated once before, that those parts of the brain which permit of the most successful surgical interference are those which offer the most exact differential diagnosis and localization.

In cases of brain tubercle.

If the presence of other symptoms of **tuberculosis** has led us to a diagnosis of a brain tubercle, an operation is only indicated:

1. If the tubercle is solitary.
2. If tuberculous meningitis or caries of the spine can be excluded.
3. If the general condition of the patient permits it.

If we have come to the conclusion that the tumor is of **syphilitic** origin, it will become an object for an operation only after the usual treatment, inunction cure and potassium iodide, has proved futile.

If we have a **metastatic** tumor before us, we will recommend operation only after the primary tumor has been removed, and after we have come to the conclusion that no other metastasis in another organ exists.

Multiplicity of a brain tumor is a strict **contraindication** in itself. While the diagnosis of a brain tumor may be difficult, and the results of the operation for it still show room for improvement, we should insist upon operation as soon as the tumor can be diagnosed with reasonable certainty and localized in the motor region. This all the more as these cases are otherwise absolutely hopeless.

Abscesses of the Brain.

To exclude a frequent misnomer, the term **abscess of the brain** must be applied only to abscesses **entirely surrounded by brain matter.**

Abscesses of the brain are nearly always of **secondary** nature, or

they are **transmitted** by the progress of an **inflammation** existing in the surrounding tissue. According to the origin we differentiate abscesses:

1. After traumas.
   (*a*) Acute, or
   (*b*) Chronic.
2. Otitic affections.
3. Rhinogenic affections.
4. Putrid diseases of the lungs and sepsis (metastatic abscesses).

Acute traumatic abscess.

1. The **acute traumatic abscesses** of the cortex are caused by immediate **contact-infection** with a primary lesion of the skull. Their **focal symptoms** of course depend upon the parts of the cortex affected. If the abscess, as is very frequent, is accompanied by a **leptomeningitis**, the original localized symptoms of the abscess are overshadowed. The **local symptoms** are: the edges of the wound of the brain soften, the **granulations** which have thus far formed become yellow and flabby, eventually **pus** can be seen oozing from the depths. The symptoms of **excitation** and afterward **paralysis** of the nerve centres develop, not as acutely as in leptomeningitis, but about the second week.

The diagnosis of a **localized, superficial abscess** of the brain is of great importance, as its **evacuation** is directly responsible for saving the patient's life. An early opening is the more necessary as we can in this way frequently prevent the forming of a secondary abscess in the cerebellum.

Chronic traumatic abscess.

The chronic traumatic abscess of the brain usually does not affect the cortex, but is more frequently situated deeper. Quite often it forms after a certain time around **foreign bodies**, such as revolver balls. The **suppuration** of course is not caused by the presence of the metal, but by **infectious material** which was carried into the brain with it. The diagnosis of chronic abscess of the brain is made possible by the fact that the **first** symptoms immediately after the injury **subside,** followed by a period which is free from symptoms. After a lapse of a certain time we suddenly see **severe brain symptoms,** very frequently connected with pressure of the brain produced by perforation of the abscess into a ventricle. The fever accompanying the abscess usually shows no special characteristics, except that it is never very high and is rather irregular. Chills are unusual. The most important symptoms are, of course, **focal symptoms,** if they are present. Frequently, suddenly developing **convulsions** preceded by repeated loud cries explain the character of the disease. In many cases we have to be satisfied to

make a **probable diagnosis** of an abscess of the brain, with its possible location, and may even have to recommend trephining for possible evacuation, where the existence of an abscess is not absolutely certain.

2. **Otitis media** is the **most frequent cause** for abscesses of the brain. They are oftenest located in the **parietal lobe** of the affected side, and in the **cerebellum,** and produce symptoms according to the centre affected. Otitic abscess.

The **differential diagnosis** of abscess from leptomeningitis is sometimes very difficult, if not impossible. The presence of meningitis without abscess can be verified by lumbar puncture.

3. The rhinogenic abscess is caused by **suppuration** in the upper **meatus of the nose** and its neighboring cavities, frontal, sphenoidal, and maxillary. **Empyema** of the **frontal sinus** may help in establishing the diagnosis, which can be made only under favorable circumstances. Rhinogenic abscess.

4. **Metastatic abscesses** of the brain are usually **multiple,** and offer, therefore, a worse prognosis than others. They are produced by **infectious emboli** which are carried from the original seat of infection, especially the lungs and the pleura. The **diagnosis** rests on the general symptoms as well as the local ones, according to the seat of the abscess. Metastatic abscesses.

Epilepsy.

It is a question if epilepsy can be called a disease, or only a symptom. Epilepsy produces at certain recurring intervals sudden **loss of consciousness,** combined with cramps which are first of a **tonic** and later of a **clonic** character. We speak of an idiopathic, a symptomatic, and a reflex epilepsy. The reasons for the occurrence of **idiopathic epilepsy** are unknown. No constant anatomical change characteristic of this disease has been found.

Symptomatic epilepsy is, as the name infers, only a symptom of other cerebral diseases, like hydrocephalus, tumors, abscesses, extended osteomalacia. The epilepsy which interests us most for **surgical** reasons is the **Jacksonian** or **reflex** epilepsy, where **scars,** depressed, irritating **pieces of bone,** and the like, produce the necessary excitation of the cortex to elicit convulsions. The fits are either the "*petit mal,*" which shows only rudimentary cramps, but with affections of the sensorium, or the "*grand mal,*" which is preceded by prodromal symptoms with tonic, and later on clonic spasms of all the muscles of the body. The patients start with a yell and bite the tongue. After the attack is Jacksonian epilepsy.

over, the sensorium is not entirely free and drowsiness continues. Jacksonian epilepsy is characteristic in being **confined** usually to **one side,** without loss of consciousness. The cramps start with twitching and trembling of the muscles nearest the affected part, and can be produced at will by pressure on the scar of the skull.

Differential Diagnosis. Epilepsy, if well developed, cannot be mistaken for anything else. In lighter cases, hysteria may be confounded with it, but the absence of biting the tongue and of complete loss of consciousness is characteristic of the latter. The indication for operation in Jacksonian epilepsy is only to be made if we have a right to assume that the epileptic state has not affected the nerve centres to a degree which makes reparation impossible. Operations for idiopathic epilepsy are contraindicated, although Horsley has recommended removal of parts of the cortex.

Diseases of the Peripheric Nerves of the Face.

1. Trigeminus neuralgia.
2. Occipital neuralgia.
3. Facial neuralgia.

1. **Neuralgia of the trigeminus. Paroxysmal pains** occurring in the course of a certain nerve, or single branch, are called **neuralgia.**

Character of pain.

The pain occurs spontaneously, suddenly, and varies greatly in its intensity. The patients describe it as of a piercing, twisting, jumping character; it sometimes acquires such intensity as to drive the patient afflicted to suicide. In some cases there are certain **points,** or spots from which we can induce the attack by **pressure.** They usually correspond with the places where the nerves or their branches leave the bone in entering the muscles of the face. The neuralgia may be confined to a certain end branch, like the supraorbital or infraorbital, or mental nerve. Fig. 5 (after F. Krause) shows the distribution of the three branches of the trigeminus. The exact localization of the nerve region is important for the operation.

The attacks are frequently accompanied by flow of tears, or profuse nasal secretion, or drooling of saliva. The skin of the face and the conjunctiva are usually reddened; sometimes an eruption of herpes is observed.

Differential Diagnosis. Severe toothache, glaucoma, migraine, cephalalgia, rheumatism of the scalp have to be excluded. The indica-

tion for an operation is given by the intensity of the pain and the desire of the patient, after other measures have been tried without success. If the neuralgia is confined to one branch, the **tearing out** of the same is indicated (neurexairesis), or **resection of the nerve** may be recom-

FIG. 5.—Distribution of the Trigeminus nerve. I., first branch; II., second branch; III., third branch.

mended, although this latter procedure very frequently shows recurrence. If this is the case, or if other small operations are without result, intracranial **extirpation of the Gasserian ganglion** is to be recommended; but as this is a dangerous operation, it should be resorted to only if all other measures fail. It shows, when successful *quoad vitam*, no recurrences.

INJURIES OF THE FACE.

Wounds of the Soft Parts.

Wounds of the soft parts of the face are so self-evident, that it is only necessary to find out their extent. They are characterized by profuse **bleeding**, as the vascularization of the face is very rich, a fact which may be annoying at the time of the accident, but which at the same time makes the prognosis very favorable, so far that even badly lacerated parts recover. The diagnosis has to determine if some of the superficial arteries are severed, as the external **maxillary** and the superficial or sometimes profound **temporal** artery. In the region of the parotid the **facial** nerve may be injured, a fact which is of great importance for the

disfiguring **paralysis** of the facial muscles following the injury. The severing of the branches of the **trigeminus** nerve is of less importance, as experience has shown that they have a great tendency to re-unite.

Fistulæ. **Injuries** to the **parotid** or **Stenson's duct** are of importance, as they are quite frequently followed by a **salivary fistula.** A fistula or a stricture may also be the result of an injury to the **lacrymal duct,** though this happens rather more rarely.

The injuries of the soft parts may be **caused** by sharp instruments or blunt force, the most extensive ones being those produced by **shots** or **explosions.** Injuries of the soft parts caused by such forces are usually **combined with fractures** of the bones, which must not be overlooked. The question of a projectile remaining in the tissues is best solved by the Roentgen picture.

Another injury that is quite frequent is more or less extensive **burns** in children by spilt hot fluids, in grown patients by escaping steam.

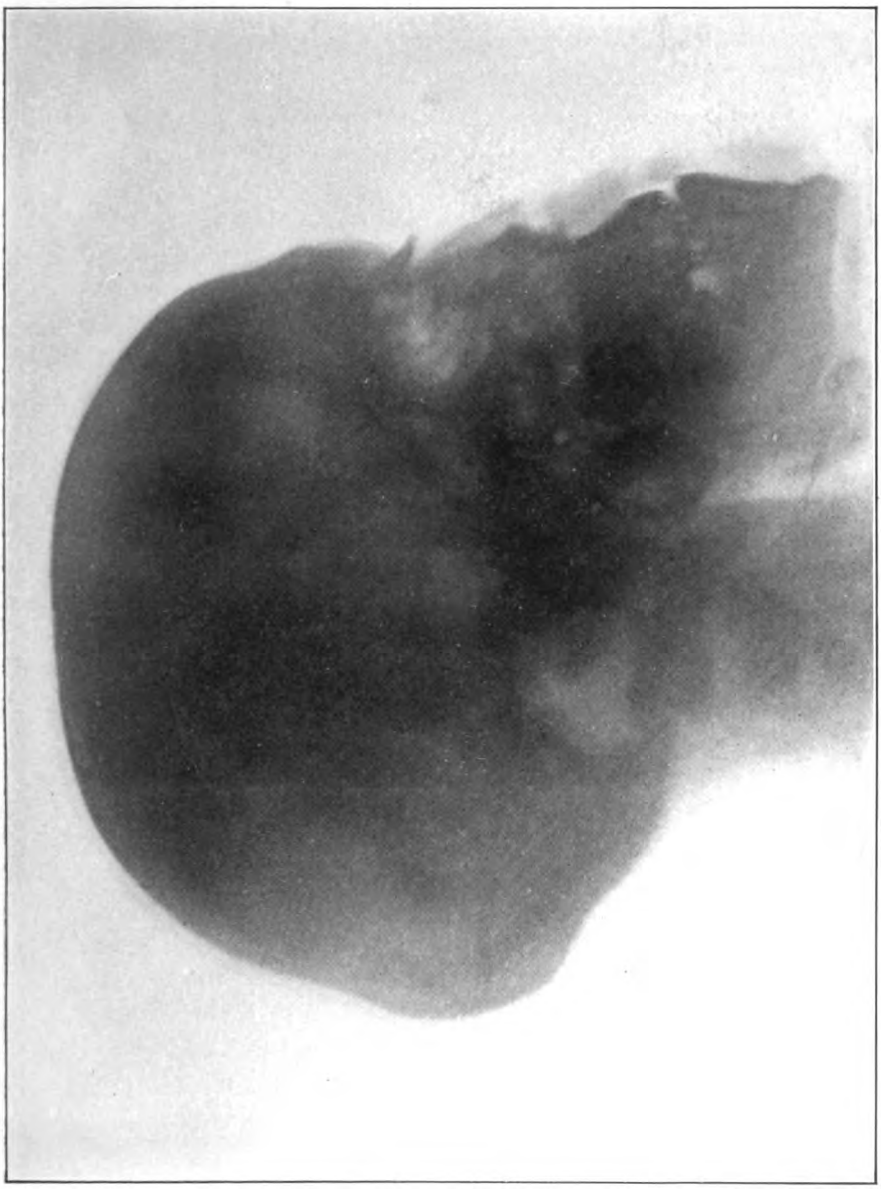
A very common injury to the soft parts of the face has been mentioned in the introduction, viz., the well-known **black eye.** While it is easy to recognize, we must **differentiate** it from possible **fracture** of the base of the skull, with its somewhat similar symptoms, described under that heading (cf. page 30).

Fractures of the Bones of the Face.

They may affect the bones of the antique, the **zygomatic bone,** and the **upper** or **lower jaw.**

1. **Fracture of the bones of the nose** is easily recognized if fresh (as long as the swelling does not conceal the fracture) by the symptoms common to all fractures, viz., deformity, pain, and crepitation. The **nose** is either pushed to **one side** or **flattened** out. The **mucous membrane** of the nose is usually **torn,** which may give rise to quite serious **hemorrhage.** Examination is best done under narcosis and the fracture made out by inserting the little finger or a female catheter into the nostrils. Pressure from without will then show crepitation and abnormal mobility. A **complication** may occur by the formation of **emphysema** of the skin and **fissures** reaching into the base of the skull.

2. Fractures of the **zygomatic bone** are recognized by the same symptoms as those described above. The deformity usually consists of a flattening of the cheek.



FRACTURE OF ASCENDING RAMUS OF THE LOWER JAW.
Produced by direct force (a kick by a horse).

3. **Fractures of the Upper Jaw.** They may be recognized by closely examining the upper row of **teeth** and the alveolar process. We have to see if the line of teeth is **uninterrupted** and if there is a tear of the mucous membrane of the hard palate. **Fractures of the alveolar process** are of importance, as they may enter Highmore's cavity. Most of these fractures are compound. Their combination with fractures of the other bones of the face above named is frequent. If other symptoms are lacking, **pain** on pressure on the **pterygoid process** is pathognomonic.

Fracture of lower jaw.

4. **Fractures of the lower jaw** are the **most frequent** fractures of the bones of the face. They are usually the result of direct force, like blows, etc., and the bone generally breaks where it is struck. There are certain places of predilection, however, especially the spaces between the **incisors** and the **canines.** If the fracture takes place there, the **dislocation** of the fragments is **typical;** the longer one is pulled downward and backward, and the shorter one becomes dislocated inward or outward. Besides the deformity, a typical symptom is the **lesion of function,** which becomes at once apparent as soon as we try to open the jaw, which then does not move as a whole, but in its parts. Further on we observe **abnormal mobility.** In establishing the same by examination with two hands, we usually produce **crepitation.** Fractures of the lower jaw are practically all **compound,** as the tear in the densely adherent mucous membrane establishes the communication of the fracture with the oral cavity. The fracture may be single or symmetrical. Besides these frequent typical fractures, some occur in the lateral parts of the body, or in the articular processes. These usually do not produce any dislocation. If an injury of the **alveolar** nerve has occurred, we find numbness of the respective half of the lip; creeping sensations, and sometimes severe neuralgias may be the result.

Symptoms.

Dislocation of the Lower Jaw.

The **dislocation of the lower jaw** is the only one which can occur without a tear in the articular capsule. The typical dislocation is **forward,** where the articular process has slipped in front of the articular tuberculum. If the dislocation is **double,** as usual, we find the mouth wide open, the chin protruding forward, so that the lower teeth are far in front of the upper ones. The **jaw** is absolutely **fixed** in its abnormal position. Local examination enables us to feel a hollow in front of the tragus, and an abnormal protuberance under the zygomatic

Symptoms.

bone. From the mouth the examining finger also feels the coronoid process under the zygomatic bone, the cheeks are flat and elongated, the masseter shows in strands, saliva flows from the mouth, which cannot be closed, chewing is impossible and speech impeded, especially pronunciation of consonants. Very frequently there is severe pain, and always a very anxious expression of the face.

If the dislocation is only unilateral, the symptoms described are to be found only on the side affected; the chin is dislodged toward the sound side.

Diseases of the Soft Parts of the Face.

Harelip.

1. **Congenital Deformities. Harelip** occurs either as median or lateral, either partial or total (leading into the nostril), single or double, all forms which can be easily recognized by simple inspection. Examination of the roof of the mouth shows if the cleft is carried on into the **palate**; if this is the case in a double harelip, very frequently the intermaxillary bone protrudes.

Other deformities.

There are deformities which occur much more rarely, viz., the median and lateral cleft of the nose, the oblique cleft of the face (meloschisis), the transverse cleft of the face, or macrostoma, and the median cleft of the lower lip and jaw. The indication for operation for harelip, with or without its complications, depends upon the severity of the deformity and the age of the child. Usually the operation ought not to be recommended before the third or fourth week; in more difficult cases not before the third to the sixth month.

2. **Inflammatory Diseases. Furuncle** and **carbuncle** of the face are produced by a staphylococcus infection (albus or aureus). They are frequently found near the mouth, nose, and forehead, and on the eyelids. They present a **typical form** of a cone-shaped, hardened mass, the apex of which is deep red; later on, when colliquation takes place, the top becomes yellow, while the redness spreads more over the surface. They are **extremely painful,** spontaneously as well as on pressure.

Furuncle.

The **furuncles of the upper lip** are by far the most **serious.** While nobody will overlook a small pustule, it is necessary to know that not very rarely these apparently harmless pimples may suddenly produce an **enormous swelling** of the lip, with **high fever.** A furuncle thus becomes a carbuncle, **infection** of the anterior facial and angular vein takes place, **thrombosis** of the cavernous sinus leads to **meningitis,** which causes

death if the disease has not ended fatally before this by general infection. All this may develop in a very few days.

Phlegmon and **erysipelas** of the face are due to infection by Fehleisen's streptococcus. They do not differ from affections of the same kind in other parts, and are only more important on account of the possible development of meningitis. It is necessary to know that there is an **habitual form** of erysipelas of the face, with frequent recurrences, which may lead to a thickening of the skin of the face.

Other chronic inflammations of the face are produced by

Syphilis,
Tuberculosis,
Actinomycosis,
Anthrax.

The **specific primary lesion** is most frequently found on the lip and, though less frequently, on the cheeks, chin, nose, eyelids. It shows the typical nature of a hard chancre. If it breaks down, the ulceration has a smeary surface, and induration of the submaxillary glands soon follows. Syphilis.

Differential diagnosis from a carcinomatous ulcer may be difficult, the more as the anamnesis in specific diseases is known to be of very little value. (Professor Billroth, of Vienna, used to say, the first symptom of syphilis is that the patient denies it.)

The late forms of syphilis of the face produce **ulcers,** which may be very difficult to discern from lupus and carcinoma. The diagnosis becomes at once clear in those cases where **saddle-nose** can be found. As in all cases of syphilis, the influence of **antiluetic treatment** is of decisive diagnostic value.

The devastation wrought in the face by specific processes is sometimes enormous. The saddle-nose we have mentioned above; besides this the soft parts may be so affected that the entire nose may be eaten away, and the lips and eyelids may also be affected with most destroying results.

Of tuberculosis we may observe a number of different kinds, which are all comprised under the name of **lupus.** Characteristic for this disease is the appearance of **small nodules** of about the size of the head of a match, covered by brownish-red skin. Soon **ulceration** sets in, destroying the bridges of normal skin between the nodules. Places of predilection for them are the nose, especially at the edge of the nostril, the cheeks and the lips, followed by affection of the chin and forehead. Tuberculosis.

Characteristic for the spread of lupus is the healing of the parts first affected with a **shiny scar** of mother-of-pearl color, while either the central or peripheral parts are still affected. Very frequently the scar is not lasting and breaks down again. A number of lupus forms do not show any tendency to ulceration, but are confined to **hyperplasia** and **sclerosis.** A frequent complication is erysipelas of the face. The **destruction of tissue** and the **shrinking** of the resulting scars are of importance, not only for cosmetic but also for functional reasons; loss of lids or ectropion, complete loss of the parts of the soft nose and the lips may result. The nostrils may even grow over, so that the orifice disappears. Quite frequently other organs are affected by tuberculosis, especially **bones and joints.** A further complication is the growth of **carcinoma** on the basis of tuberculosis.

Actinomycosis.

Actinomycosis. The typical mode of **infection** for actinomycosis is from the mouth and, to be more exact, usually from an **ulcerated tooth.** The **agent** is the actinomyces, a bacterium which grows specially on the beard of the grain and occurs in the jaws of cattle, sometimes the pig and horse. The bacterium in man is found in characteristic **yellow,** somewhat hard, **sandy grains,** which can be expressed from the crater of an ulcerated actinomycotic induration with a thin grayish serous discharge. From its above-mentioned typical starting-point the disease slowly affects the cheek and penetrates the same, usually at the anterior edge of the masseter. One of the first **functional symptoms,** before anything is to be seen on the outside, is therefore **spasm of the jaw.** When the local affection becomes visible, it forms at first a more or less diffuse, later on more circumscribed **infiltration** "as hard as a board."

Diagnosis.

The tops of the irregularly formed nodules break down, with the above-named characteristic discharge. The diagnosis may be difficult, though the characteristic **prolific growth** of doubtless inflammatory character, with **irregular decay** not following any other known type of inflammation or neoplasm, must induce a good observer to look for the above-mentioned yellow grains, which contain the specific bacterium.

There are other ways of infection, as, for instance, through the lungs, and I may mention here, to avoid repetition later on, that the disease is not confined to the jaws, face, and neck, but may attack any other part of the body.

Anthrax.

Anthrax (malignant pustule). Anthrax is an acute infectious disease due to a **specific agent,** the anthrax bacillus, which is one of the most common and at the same time disastrous infections of cattle in

various countries. In North America it is comparatively rare. The disease is **transmitted** to man by contact or inhalation or by the bites of **insects,** which have drawn blood or infectious material from a live or dead victim of the disease. The face (and the hands) are the principal places of localization. As the name, malignant pustule, indicates, first a small, reddish, itching **pustule** or furuncle is formed, which usually contains a large number of anthrax bacilli. The **infiltration** increases, a dark scab forms on the furuncle, after it has opened; the resulting **ulcer** decays in the centre and spreads to the size of a silver dollar. The disease is very frequently **fatal** in a short time; in other cases a more **chronic course** is observed, which not unfrequently leads to recovery.

3. **Neoplasms.** The entire series of all tumors produced by **connective tissue** and **epithelial** cells, from lipoma to carcinoma, may occur in the face. Tumors.

Lipomas are rare, are most frequently situated on the cheek, sometimes on the lips and lids. They have to be recognized by their **lobular structure**. If this is lacking, differential diagnosis from other benign tumors and cysts may present difficulties.

Fibromas are quite frequent. The flat **nævus,** with or without hairs, is well known. A most important form is the **fibroma molluscum,** a soft, multilobular growth with gourd-like forms and multilocular character. If it attains the latter form, it is frequently called **elephantiasis.**

The angiomata are represented by the **lymphangioma** and the **hæmangioma,** the former being rare, the latter quite frequent. The former presents itself as a spongy **swelling** of the lips (macrocheilia) or the cheeks (macromelia), which can be slightly lessened in size by compression. As the cutis and subcutis are affected, the skin cannot be lifted from the growth. The color of the skin is normal, not showing any of the bluish or reddish characteristics of the hæmangioma.

In close connection with lymphangioma or lymphangiectasia are a number of other swellings, which may be comprised under the name of **inflammatory hyperplasia.** Certain forms of elephantiasis belong hereto, as well as scrofulous swelling of the lips and **rhinophyma,** that disfiguring monstrosity of the nose of dark bluish-red color, resembling in form the gnarled excrescences on a tree.

Angioma in its simple as well as its **cavernous form** occurs quite frequently in the face, especially the lips and lids. They are either flat, like the well-known red birthmarks called nævi, or assume the form and size of a blackberry or larger. They are compressible, and may pulsate Angioma.

if in connection with an artery. They are sometimes erectile by vasomotor influences, like the dark-blue hanging angiomata of the upper lip.

Atheroma, dermoids and other cysts are comparatively rare in the face and show no peculiarities differentiating them from those which occur on other parts of the body.

Malignant tumors.

The **sarcomas** of the face are practically confined to the orbita and the parotid. Besides these the pigmented or **melanosarcomas** of the skin occur anywhere in the face, and are easily recognized as such. The **sarcoma of the orbita** is frequent, and marked by rapid growth, presenting a tumor with knobby surface, non-fluctuating, non-pulsating, incompressible and very hard. An early diagnosis is of high importance, for the destructive effect of sarcoma on the eye and all its adnexa is marked.

Diagnosis.

Carcinoma occurs more frequently in the face than in any other part of the body. The feature most frequently affected is the lower lip, then in diminishing order the nose, cheek, lids, upper lip, chin. One striking quality of the carcinoma of the lower lip is the fact that it is almost exclusively confined to the **male sex.** The carcinoma of the lower lip presents such a typical picture with its circumscribed hardness, involvement of all the tissue, the crater-like ulceration on the mucous membrane of the lip, and the early involvement of the neighboring glands, that it can hardly be mistaken for anything else. Microscopical examination should only verify the diagnosis. Early exact diagnosis is of high importance, though the cancers of the lip are not quite so malign as those of other parts.

The **flat carcinomas** of the face, especially of the cheeks, produce less of a tumor, and ulcerate sooner. They very frequently start to grow on the brown, seborrhœic spots common in elderly people, and are of importance as they quite frequently engage the lower lid, thus producing ectropion. They are comparatively benign, but require, of course, like all cancers, immediate and most thorough removal. The results of operation are favorable.

Tumors of parotid gland.

If we are to include the **parotid** in the face, we have to mention the mixed tumors so characteristic of the salivary system. The most important part is played by the enchondro-sarcomas and carcinomas, myxosarcomas, adenomas and myxadenomas. The tumors producing cartilage (enchondromata) are stone-hard, movable under the skin and on their bases, and remain benign for a long while. The **carcinomas** show more a tendency to ulceration, and usually produce **functional**

disorders, as facial paresis and pain, sooner than the mixed tumors. Their prognosis is decidedly worse than that of the latter. As the differentiation may be sometimes extremely difficult, **total extirpation** of the parotid or submaxillary glands, as soon as they are affected by a malign tumor, ought to be decided upon.

Diseases of the Bones of the Face.

The inflammatory changes produced in the bones of the face by infectious diseases, as tuberculosis, syphilis, actinomycosis, have been mentioned with the corresponding diseases of the soft parts. We have only to mention then the **ostitis** of the jaws known as tabetic, phosphor, and mother-of-pearl ostitis.

The **tabetic ostitis** is to be recognized from the existence of the original disease, and the fact that perfectly healthy teeth become loose and fall out without any pain whatsoever, and from the atrophy of the bone.

Chronic forms of ostitis of jaw.

Phosphor necrosis, with its frightful devastations and its fatal termination, is now practically unknown, since the use of white phosphorus in the fabrication of matches has been forbidden by various governments, and has been replaced by red phosphorus. The disease attacked principally the **lower jaw,** practically destroying it in its entirety; the periostitic growth surrounding the necrotic bone does not really produce new bone, as in osteomyelitis for instance, supplanting the dead bone.

The disease known as **ostitis of mother-of-pearl** workmen occurs only in **young** individuals about the age of puberty. Its pathology is entirely **unknown,** and it is sufficient to know this occupation as an etiological factor of necrotic ostitis of the jaw.

The **osteomyelitis** of the jaws has been recognized only in late years. The **lower jaw** is more frequently its seat than the upper. We discern the **diffuse** from the circumscribed form. The first nearly always ends fatally, lasts only a few days, and shows all the symptoms of **foudroyant inflammation** of the bone with its surrounding tissues: enormous swelling, unbearable pain, complete loosening of all the teeth, chills, and very high fever.

Acute ostitis.

The **circumscribed form** is recognized by a sudden loosening of one or a number of adjoining teeth at a point where the jaw is swollen and exceedingly tender. The swelling quickly spreads under similar, only

less violent, symptoms as observed in the diffuse osteomyelitis. Later on, usually not very large sequestra are formed, which need extraction (not the teeth, which usually become firm again).

Diseases of the Mouth.

Of the diseases of the mouth we have to mention cysts, owing their origin to the **retention of saliva** in salivary glands. Either the salivary duct, like Wharton's duct, is widened into a cyst, or the closure of a duct retains the fluid. In both cases, expression of thick mucus or establishing the presence of the same by puncture furnishes the diagnosis.

The **ranula,** a cyst beneath the tongue, uni- or bilateral of the frenulum, is quite frequent. It presents a fluctuating tumor, from the size of a hazelnut to that of a billiard ball, of bluish color. There is no pain connected with it and it gives functional symptoms only by its bulk, especially if it occupies the entire floor of the mouth.

Malformation, Injuries and Diseases of the Tongue.

Congenital Deformities. The so-called **tongue-tie,** an alleged condition where the frenulum is too short for the proper use of the tongue, as for sucking and later on speaking, is a **myth,** and exists only in the mind of mothers and unreliable observers.

Macroglossia is a congenital general enlargement of the tongue, in which all the tissues participate. It is more properly called **diffuse congenital lymphangioma,** and is easily recognized as such. The disproportion between the member and the space allotted to it frequently produces decubital ulcers of the tongue.

Injuries of the Tongue. They are usually produced by accidental closure of the mouth on the tongue in a fall, blow, etc., only rarely by instruments, and then usually in children or insane patients.

Case. I once had occasion to excise a button-hook from the root of the tongue of a fourteen-months-old child of unusually strong development. In an unwatched moment the boy had hooked himself.

Tongue-bites most frequently occur in epileptic patients. The examiner should know that quite deep lacerating wounds may occur with apparently little injury to the mucous membrane of the lower surface of the tongue.

Diseases of the Tongue. The simple inflammation of the tongue (**glossitis**) is due to an **infection** from a surface **wound** and is easily recognized by its lack of other etiological factors, the mode of entrance of infection, and its short duration. As the swollen tongue may interfere with breathing, the cases have to be watched closely. Acute glossitis.

Two organic diseases may show their symptoms in the tongue, tuberculosis and syphilis.

Tuberculosis may appear either in the form producing nodules or in the miliary disseminated form. The **nodules** appear mostly on the tip and sides of the tongue. They break down very soon and undermine the edges, which is characteristic. The bottom of the ulcer is flat, smooth, torpid, pale, with little discharge.

Disseminated tuberculosis quickly spreads over the gums, buccal membrane, etc. Sometimes it spreads so fast as to resemble an acute phlegmonous infection of the mouth. The **submaxillary glands** are affected to a large extent, usually on both sides. Chronic glossitis.

Differential diagnosis has to consider syphilis and carcinoma. See below.

Syphilis. Primary lesion is, in contrast to that of the lips, cheeks, and the cavity of the mouth in general, extremely rare.

Later manifestations are quite frequent. They appear mostly in the form of **gumma,** with all its characteristic signs and its more or less pronounced tendency to break down. The gumma is tender only on pressure, not spontaneously, and is usually **multilocular,** and the ulcer does not spread, or does so only slowly. As in other cases of lues, energetic specific treatment is indicated for diagnostic purposes. If such is instituted, a case of tuberculosis mistaken for syphilis rapidly grows worse.

Carcinoma of the Tongue. It starts as a hard, ulcerating small nodule, which is soon observed by the patient, because it is extremely **painful,** a symptom which is pathognomonic for cancer. The cancer, true to its nature, **attacks all tissue** within reach equally. The previously soft tongue tissue becomes quickly transformed into a **hard, stiff mass,** from the surface of which frequently yellowish-whitish plugs can be expressed. The **sublingual glands** are very soon involved, and after a short while the tongue, floor of the mouth, and glands form one hard, stiff mass, the pain increasing all the while. Cancer of tongue.

The cancer usually does not appear before the **fiftieth year,** following the usual tendency of cancerous growth to appear in the later stages of life.

The prognosis is so bad that only very early diagnosis gives the patient a chance.

As an etiological factor, **leucoplakia** has to be considered, although the latter in itself is an apparently harmless disease. It is characterized by the formation of a peculiar white **thickening of the epithelium** of the tongue. This disease itself again has to be differentiated from the **glass-blowers' tongue;** but in the latter the plaques are symmetrical, showing a predilection for Stenson's duct as their site.

Differential diagnosis between tuberculosis, syphilis, and carcinoma should be guided by the following characteristics, while absolute certainty is furnished only by the **microscope** after probatory excision.

	Tuberculosis.	Syphilis.	Carcinoma.
Etiology	Infection by sputum rich in bacilli.	Venereal history.	Leucoplakia. Smoking (?).
Age	Any	Any after puberty.	After 45 years
Sex	Both	Both	Male.
Seat	Point and sides; mutilocular.	Lower surface and edge; multilocular.	Unilocular; never on tip or dorsum.
Pain	Very little spontaneously.	None	Extreme.
Hemorrhage	None	None	Early.
Temperature	Normal to 102° F.	Normal	Normal.
Form of ulcer	Superficial, with pale yellow, small nodules. If decaying, yellowish, cheesy matter; edges undermined.	Thickly coated, lardaceous; after ulceration, tumor gives way to ulcer.	Even after decay, tumor plainly recognizable. Expression of plugs.
Size of ulcer	Small	Growing with progress of disease.	Growing with progress of disease.
Nature	Soft	Medium	Hard.
Deeper tissues	Usually not involved.	Slightly infiltrated.	All tissues implicated.
Glands	Soft, painless, large.	Early implication.	Carcinomatous degeneration.
Recurrence	None	Frequent	None after early excision.
Probatory treatment	Antiluetic treatment aggravates.	Results after 6 to 8 days.	No effect.
Microscopical examination	Bacilli; large round cells.	Not typical	Typical picture of cancer only in *deep* excisions.

Congenital Malformations and Injuries of the Ear.

While the formation of the outer ear is so different in different individuals that a special system of recognizing criminals has been worked out by the configuration of their ears, real **deformities are rare** and so easy to recognize that they offer little interest for surgical diagnosis. Conchæ that stand out almost at right angles to the head sometimes require operation for cosmetic reasons.

Wounds of the outer ear are comparatively rare, while congelation happens quite frequently. They all show no special characteristics differing from similar injuries to other parts. Wounds.

Foreign bodies in the external meatus occur quite often, especially in children. In fresh cases they usually can be easily detected by inspection. They generally lie right **behind** the projecting **limen conchæ.** If they are farther in, they usually have been pushed there by misdirected efforts to get them out, either by the patients themselves or, much more frequently, by blundering physicians. The **warning** against indiscriminate **use of probes** and other instruments for diagnostic purposes, given in the introductory chapter, has to be urged with special emphasis for the meatus. Besides inanimate bodies, like buttons, glass beads, wads of cotton, etc., we find insects as inhabitants, such as small cockroaches (Blatta orientalis and occidentalis), bedbugs, etc. If they can move and stay alive, they may cause extremely loud noises in the ear. A momentary failure to detect these foreign bodies is usually of small consequence, as they may stay in the meatus for quite a while without doing any serious injury. Foreign bodies.

Perforation of the ear drum is usually the effect of sudden changes in the **pressure of the air.** Increase and decrease are equally responsible. Even slight changes of pressure, as a kiss applied on the ear, sudden withdrawal of an inserted finger, boxing of the ear, may be responsible. Explosions, shooting off of a cannon, belong to the more violent causes of rupture. A special form of ruptures is presented in divers, with or without the helmet, especially without. Traumatic perforation of membrana tympani.

Fractures of the base of the skull quite frequently result in tearing of the drum by indirect force.

By direct force the drum is perforated by accidents, or misdirected efforts for extrication of foreign bodies.

The diagnosis of rupture may be quite difficult without use of the

Diagnosis.

syringe for removal of blood clots, etc., which is strictly **contraindicated.** The loss from non-establishment of the diagnosis is very small, simple cases healing in a few days, and the more serious ones usually are not of very urgent character. The principal rule, more stringent here than anywhere else, is *nil nocere.*

Diseases of the Ear.

Diseases of the Meatus. Furuncles are most common in the meatus, and **differ** from others in that the tension and density of the tissue do not permit the appearance of redness, so that they have to be recognized from their **conical shape** only, the more so as the yellow plugs are quite hard to see.

Diseases of the Middle Ear. By far the most important disease of the ear is inflammation of the middle ear, either acute or chronic.

Acute inflammation.

Acute inflammation shows as its principal symptom, even in light cases, **pain.** It usually sets in suddenly, and soon achieves a high degree of violence. It is usually described as a drilling, hammering, and piercing pain, and **radiates** quite frequently to the mastoid. After a very short time the spontaneous pain is accompanied by tenderness on pressure; even merely touching the concha or the mastoid region is unbearable. The well-known little gland on the mastoid, which if chronically inflamed is a pathognomonic sign of lues, also becomes involved.

Another symptom is the **pulsating, buzzing noise** in the ear. Headaches, feeling of pressure in ear and head, slight rise of temperature, characterize the lighter forms. With the **increase** of the **inflammation** the symptoms are those of an acute serious infection, with temperature of 104° and 105°. Small children develop the most alarming symptoms, with affection of the sensorium and convulsions. Immediately after the **perforation,** spontaneous or *per operationem*, the symptoms quickly disappear.

Chronic form.

Chronic Inflammation of the Middle Ear. It is of high diagnostic importance, as it frequently leads to serious **complications,** the most important one of which is the extradural or subdural **abscess,** or the genuine abscess of the parietal lobe of the cerebellum. The disease is characterized by **discharge** of more or less sero-purulent matter of light or yellowish-green color, frequently mixed with crumby or cheesy matter. Offensive smell is not rare. Future complications depend upon the localization of the process. Abscesses of the parietal lobe result from

suppuration of the anterior part of the epitympanic recess, that of the antrum shows a tendency for phlebitis of the sinus and abscess of the cerebellum. If the labyrinth is involved, **meningitis** is probable.

Tuberculosis of the middle ear is very frequent and shows the same symptoms, except that bacilli may be found in the discharge. Tuberculosis.

The neoplasms of the ear are comparatively of such rare occurrence that their description may well be left to special books.

Diseases of the Tonsils.

Inflammation. The acute inflammation of the tonsils is a disease easily recognized. The general symptoms are those of an acute infection, as sudden rise of temperature up to 104° F., frequently preceded by a chill, and general malaise. The **subjective local symptoms** are: a sudden piercing pain in the pharynx, as if produced by a foreign body, like a needle or bristle, and a gagging sensation in swallowing. The **objective** local symptoms are injection of the tonsils and the surrounding tissue, especially the uvula, accompanied by swelling. White specks of flat or nodular form appear on the tonsils, which if confluent may indicate a diphtheritic affection. But as they stay confined to their original locality and do not spread, their **differentiation** from diphtheritic affections should not be difficult. In the same way the infectious character of the disease prevents us from mistaking it for a syphilitic process. Acute tonsillitis.

Hypertrophy of the Tonsils. It is easily recognized by the increase of bulk. The symptoms produced are comparatively light and have been greatly overrated, only in extreme cases free breathing is interfered with, while a great many of the symptoms ascribed to hypertrophy of the tonsils are due to hypertrophy of the pharyngeal tonsils.

The hypertrophy is frequently combined with adenoids, and hypertrophy of the **third tonsil,** thus producing the well-known complex of symptoms so frequently observed in children of scrofulous habitus. But it is necessary to know that the hypertrophy of the palatine tonsils is responsible only in small degree for this condition. Chronic diseases of tonsils.

Tuberculosis of the pharynx is quite rare. If tubercle bacilli are found, the diagnosis is established.

The secondary syphilitic affection of the pharynx is one of the most typical, and easily recognized as syphilitic, since the symptoms of that disease are seldom lacking, even if the etiological factor is not admitted by the patient. It affects especially the **soft palate,** while the other parts Syphilis.

of the pharynx are less subject to the attack. It usually appears at the same time with the **eruption** on the skin, for which we may look as further proof. The obstinate character of these ulcers is typical.

Tertiary forms usually appear not before the third year, sometimes as late as the tenth year.

Malignant growths.

Sarcoma and carcinoma of the tonsils are the most important tumors. As usual, the carcinomas are accompanied by intense **pain** in the early stages, which is lacking in sarcomas. The early involvement of neighboring tissue, the hardness of the tumor itself, swelling of the glands, besides the appearance of the surface, ought to make the **diagnosis** easy. It is necessary to make it early, as the prognosis otherwise is exceedingly infaust.

Retro-pharyngeal abscess.

Retropharyngeal abscess is not infrequently the result of **caries** of the cervical vertebræ, or of an **inflammation** of the retropharyngeal glands. Exhausting infectious diseases, as measles and scarlatina, whooping-cough and erysipelas may be responsible. It occurs most frequently with babies in their first year, and palpation, the only method of examination for ascertaining the diagnosis, may then be difficult. The **tumor** grows very rapidly, indicating the formation of an abscess. **Clinical symptoms** show, besides the general character of an infectious disease, difficulty in swallowing, and, later on, in breathing. The latter is produced not only by the bulk of the abscess, but also by the swelling and œdema of the surrounding tissue, and may become so acute as to necessitate immediate action. In spite of these very characteristic symptoms, retropharyngeal abscesses are quite frequently overlooked.

INJURIES AND DISEASES OF THE NECK.

INJURIES TO THE VESSELS AND NERVES OF THE NECK.

The **arteries** which may be injured are: Subclavian, vertebral, and common carotid, the latter being by far the most frequently, specially in tentamen suicidii, while the external or internal carotid is more rarely injured, usually by shot or thrust.

The principal symptom is **hemorrhage**. According to the conditions of the wound, the blood escapes freely, or infiltrates the surrounding tissues, or runs partly into a cavity which may have been opened. The diagnosis whence the hemorrhage comes, may be very difficult, as even the **differentiation** between venous and arterial hemorrhages, usually so easy, may here be wellnigh impossible. If the primary hemorrhage has stopped, secondary bleeding may take place as late as the fourteenth day.

Besides injury to the arteries, wounds of the neck may include **lesion of the veins and the vagus**. It is a question which hemorrhage is more dangerous. Both very frequently lead to death within a very short time, and if there is time for any interference, the exact diagnosis can usually be established only on the operating table. Severed veins are connected with a special danger, that of aspiration of air, which, if it takes place, usually ends fatally. The occurrence of entrance of air into a vein of the neck is much rarer now than formerly. Probably its frequency has been overrated. If it does happen, it is characterized by a single or repeated **gurgling sound**, after which the patient becomes pale with an anxious expression, respiration becomes labored, the pulse frequent, weak and irregular, and after loss of consciousness, death occurs.

Aspiration of air by a severed vein.

Injuries to the **vagus** and other nerves of the neck are extremely rare; they most frequently occur during operations. The usual **symptom** is paresis of the vocal cords, producing hoarseness, while influence on respiration or pulse is to be observed only very rarely.

The chapter on injuries of the neck may be closed with the remark

that in **self-inflicted wounds** the vessels and nerves usually escape injury, owing to their elasticity as well as the position in which the patients hold the neck during the act.

Congenital Deformities of the Neck.

Branchiogenous Fistulas and Cysts. If Rabl's branchial canal does not close, the result is a branchial fistula. It may occur either in the mesial line or laterally. If the inner end of the canal has closed, we find an **external incomplete** fistula; if the outer end has closed, an **internal** incomplete fistula presents itself. If both stay open, the fistula is called **complete.** If both are closed, we find a branchiogenous cyst, which may appear anywhere on the neck, as a round elastic uni- or multi-locular fluctuating tumor, with **contents** corresponding to its derivation from the epithelial inner coat of these cysts, resembling very much the contents of dermoids. It is claimed that an ice-bag applied for diagnostic reasons congeals the pulpy or oily contents.

Cystic hygroma.

The congenital cystic hygroma is formed by continuous **dilatation** of lymphatic ducts. It usually appears in the upper parts of the neck, near the jaw, in front or behind the sternocleido. It fluctuates, and shows little tension; the covering skin is usually not adherent. The tumor is non-compressible and non-erectile. It usually contains clear serous fluid, which is sometimes milky, opalescent. Probatory aspiration can therefore establish the difference between a hygroma and branchiogenous cyst. The prognosis is exceedingly infaust, children afflicted with this disease hardly ever reaching maturity.

DISEASES OF THE NECK.

Wryneck (Caput obstipum).

Wryneck is **congenital** or develops shortly after birth. It is a deformity due to a **shortening** of one **sternocleido** muscle, producing a faulty position of the head. The head is inclined strongly toward the

Symptoms.

side of the shortened muscle, for instance to the right (which is more frequent), and the face is turned toward the left (the sound side). If we try to get the head in normal position, the shortened muscle protrudes like a cord. The **skin** of the affected side sometimes shows cross-folds; the carotid pulse is to be felt very indistinctly, while it is plain on the

sound side. The **motions** of the head are influenced according to the degree of the disease; active and passive motion is painless. There are two different types, one, where the inclination is most pronounced with little torsion of the face toward the sound side, the other shows reversed conditions. The shortening of the muscle results in the formation of a **cervical scoliosis** toward the sound side, which in many cases is compensated by a dorsal scoliosis in the opposite direction.

Two types.

In severe cases the face shows a marked **asymmetry,** the affected side is lower and broader than the other, a line drawn through both the outer angles of the eyes and a line laid through both corners of the mouth converge toward the affected side.

The **diagnosis** is frequently not established until children begin to walk. Exact observation and examination should disclose the affection before that time. This is important, as surgical treatment, orthopedic as well as operative, ought to be applied in the early stages.

We might mention here the spasmodic wryneck, which has nothing to do with the affection described above, but is due to **spastic conditions** in the distribution of the **accessory nerve.** We do not know any etiological reason for this condition.

Spasmodic wryneck.

In **clonic spasm** of the accessory there are brief or more persistent twitchings of the head, which may attain great severity. Where there is a predominating unilateral **spasm of the sternomastoid,** the head is turned to the opposite side at every contraction of this muscle and the chin is also somewhat raised. In tonic spasm of the accessory the head is constantly fixed in the abnormal position described above, and it cannot be brought back passively to its normal condition, or at least can be brought back only incompletely.

The rheumatic torticollis hardly belongs here, since it is probably due to a rheumatic **myositis** of the **sternomastoid.** In some cases the twitching ceases entirely when the body is wholly at rest, but it returns at once on any voluntary movement. In pronounced cases the spasms continue day and night, being so severe as to prevent sleep.

Rheumatic torticollis.

Inflammations of the Neck.

Furuncles and **carbuncles** occur very frequently in the region of the neck, and show the characteristic symptoms common to these infective inflammations.

Besides the **acute** unilocular furuncle we find quite frequently a

chronic form, where one hair-follicle after the other becomes infected, and thus a state may be produced, which may be rather obstinate.

Phlegmon and abscess.

Phlegmons and abscesses of the neck are in every respect similar to those of other regions, with the exception that the **anatomical conditions** may produce special symptoms. The etiological factor is represented as usual by the staphylococcus and streptococcus, besides the specific bacilli producing pus, like the pneumococcus and typhoid bacillus. A special bacterium is the anaerobe bacterium which produces the gas phlegmons of the neck.

Submaxillary phlegmon.

By far the most frequent form is the submaxillary phlegmon. We find a dense **swelling**, covering the upper triangle from the chin down to the thyroid cartilage and back to the anterior edge of the sternocleido. There is generally little malaise, the phlegmon becomes soft and an abscess forms, which works through to the outer surface. If the connective tissue of the capsular space is infected, we see a condition known under the name of **angina Ludovici**. The patients affected usually are between fifteen and thirty years of age, and male. The clinical aspect is much more serious than that of phlegmon elsewhere; the patients show all the symptoms of acute infectious disease; besides the **general symptoms,** difficulty in swallowing and breathing accompanies the formation of the swelling, which is very dense and hard, exceedingly tender to the touch, and rather diffuse. As the deeper layers are first affected, the skin does not show in the beginning any redness or œdema, which appears only after a few days. The patients hold the head toward the affected side, with an anxious expression. The mouth can hardly be opened at all, and the floor of the mouth shows considerable swelling, pressing the tongue upward, and thus interfering seriously with respiration. This picture is so pronounced that it cannot be mistaken for anything else. An **early diagnosis,** guaranteeing proper surgical treatment, is important, as the prognosis is very infaust. This affection is comparatively rare.

Phlegmon of the sheaths of vessels.

Quite frequent is phlegmon of the sheaths of the vessels; it develops according to its anatomical boundaries directly beneath the sternocleido muscle. High fever and severe pain accompany its formation. As the affected tissues are under high pressure, collateral œdema ensues and interferes with swallowing and breathing. The floor of the mouth though is never affected, nor the tongue. In some cases, as after scarlet fever or measles, all these symptoms may disappear, but usually the affection leads to an **abscess**. As the patients suffer greatly, an early operation opening the fascia is indicated.

In contrast to these acute inflammations of the neck we observe **chronic abscesses** due to organic diseases, as tuberculosis and actinomycosis.

Lymphadenitis. Lymphadenitis, or inflammation of the glands of the neck, is very frequent. The acute forms due to the affection of the glands from any cause are easily recognized as such. The chronic form is represented by **tuberculous glands,** by far the most common chronic affection of the neck. The infection usually takes place through the mouth, even in patients who are not tuberculous otherwise. They then very frequently represent an entirely local infection, which may, under appropriate surgical treatment, heal without further infecting the individual.

Tuberculous glands. The scrofulous condition of patients in general and of the glands of the neck in particular is now acknowledged only in so far as we call **scrofulosis a predisposition toward tuberculosis.** There are a number of different forms of tuberculous glands according to their pathological history. Sometimes the glands are purely **hyperplastic,** at others they show a tendency to caseous **degeneration;** some are confined within the capsule of the gland, while others grow through it, etc. For us it may suffice to say that the glands in their arrangement form a **chain,** the links of which may be very different in size. Sometimes, especially if the formation of an abscess has taken place in one gland, its size (as large as an egg or potato) may overshadow all the others, so that they might be overlooked—a mistake made quite frequently by practitioners, thus underrating the extent of the affection; but if the head of the patient is inclined to the affected side, to release tension, we easily find the entire chain. There is usually very little pain and the temperature does not rise above 102°. As these glands represent a **tuberculous focus** and thus a constant danger of general infection following the lymphatic ducts, this condition should be recognized early that we may lose no time in recommending radical surgical treatment.

Differential diagnosis. There is little difficulty in differential diagnosis in these cases, only the rare affection of **actinomycosis** and the also very rare **syphilitic** affection of the glands of the neck are to be considered. In doubtful cases microscopical examination will decide the diagnosis. If patients in later years of life (tuberculous affection of glands usually appears in children and adoloscents) are attacked, the differential diagnosis may become somewhat more difficult, and may be decided only after extirpation.

Malignant lymphoma represents the **connecting link** between in-

Malignant lymphoma.

flammation of the glands and tumors of the neck. To correct a very frequent misconception, we have to state now that this disease is not malignant in a sense that it forms metastases in other organs. It **affects glands** only; besides those of the neck, the glands in the axilla, inguinal region, etc. The disease never perforates the capsule of the individual glands; in other words, never affects heterogeneous tissue. It never produces anæmia, a fact proved beyond doubt despite former assumptions. We differentiate the soft from the hard form. The age of those affected is from fifteen to thirty-five. The **formation of tumors** usually begins on the neck, where patients, thus far perfectly healthy, show a painless (therefore very frequently overlooked) formation or swelling of one gland, which grows individually as well as by attacking the neighboring glands. The general condition of the patients is unimpaired, so that they look and feel perfectly well. After a while the other regions of glands are affected and usually the patients are lost. Even very radical extirpation is followed by early **recurrences.** During all that time the contours of the glands are to be felt, as the process is confined by the capsule, suppuration never taking place. The disease has also been called **Hodgkin's disease.**

Lymphosarcoma and **sarcolymphoma** offer occasionally so great difficulty in the diagnosis that sometimes it cannot be established until after excision.

Other tumors of the neck not connected with the glands are **fibroma,** which is very rare, **lipoma,** which is very frequent, and **carcinoma.**

Lipoma.

Lipoma occurs in two different forms: the **circumscript** one, by far the more frequent, and the diffuse lipoma. The former occurs especially in the nape, and is characterized by its sharply circumscribed configuration, produced by its capsule of connective tissue. The tumors, while usually small, may reach a very large size, up to fifteen pounds.

The **diffuse** lipoma occurs usually in men above fifty, forming an exaggerated double chin, which spreads backward and upward.

Carcinoma.

Carcinoma of the neck is in rare cases primary; it then starts from the epithelial layer of the branchiogenic duct. Much more frequently we find a **secondary** carcinomatous degeneration of glands of the neck, usually starting from a possibly overlooked carcinoma of the larynx.

Lymphosarcoma, tuberculous glands, and actinomycosis may come into consideration for differential diagnosis.

Lymphosarcomas are usually softer, but tuberculous glands may be very hard and thus give the impression of carcinomatous glands. If otherwise impossible, differential diagnosis must be established by **probatory excision.**

Aneurisms.

It is necessary to recognize aneurism of the neck, to avoid serious mistakes. By far the most frequent artery affected by aneurism is the **common carotid.** Usually men of younger years are subject to it. The size of the tumor is very varying, sometimes occupying the entire side of the neck. The form is usually ovoid, very rarely spheric. The direction corresponds with the situation of the artery. Pulsation and systolic bruit are usually present, but may be absent if coagulation has taken place. The tumor is always compressible and resumes, after the pressure is released, its former size. An important symptom is **paralysis** of neighboring nerves, which is pathognomonic for aneurism. Aneurism never follows the motion of the larynx in swallowing. The symptom on which great stress has been laid is the fixedness or movability of a tumor of the neck. For **differential diagnosis** I find this point is of value only to the very experienced examiner, as, for instance, tuberculous glands with a pronounced periadenitis may show exactly the same symptoms in this regard as a carcinoma of the neck. The surrounding tissue being soft, it simply follows the motion of the tumor, except where the layer is attached to the spine. And even then, if the tumor is pedicled, it may give the impression of being really movable. Symptoms.

The external and internal carotids, as well as the innominata and the subclavians, may be affected by aneurism, but rarely in comparison with the common carotid.

DISEASES OF THE THYROID GLAND.

Goitre (struma) is,

1st, either a disease as such, or

2d, a symptom of another disease called Basedow's or Graves' disease.

(1) The true goitre is a **hypertrophy** of the thyroid gland, and seems to be an endemic disease, which occurs much more frequently in the Tyrol, Switzerland, and Northern Italy, than in other regions, and is a rare occurrence in the United States, except among foreigners.

The hypertrophy affects the organ either in toto or only partially. A number of different forms are observed, which may be either cystic or vascular, or more solid, according to the location of the tumor. The latter may have influence by compressing the trachea, œsophagus, the vessels and the nerves. Of these symptoms the most striking is the one produced by the **pressure on the trachea,** which may either be shoved to one side or compressed from both sides in scabbardlike form, or the wall of the trachea itself may be affected. This produces shortness of breath and palpitation of the heart; at the same time stridor exists, that is, the inspirations are unusually deep and long, and produce a whistling sound. If the difficulty of inspiration is increased, acute asphyctic attacks may occur, which are due either to a highly developed stricture of the trachea or to **pressure on the nerves,** especially the abductors or the recurrents. Swallowing is usually not interfered with. Compression of the **vessels** produces cyanosis of the face and palpitation; the pulse is irregular and dizziness frequent. Affection of the nerves is shown by the fact that the voice is either not clear and easily gives out, or the patients are completely aphonic. Hindrance in respiration is shown only during inspiration, as the glottis is in a complete cadaveric position.

Symptoms.

Local symptoms.

The local symptoms are very striking. We see at once the tumor, its **situation** (whether mesial, left or right of the thyroid cartilage) and its **shape,** as well as the enlarged veins. Sometimes the carotid pulse is to be seen behind the sternocleido. A very **important symptom** is that the goitre moves up and down in deglutition according to its dense attachment to the trachea. As the patients have trouble in swallowing, one has to give them water to gulp down during examination. In swallowing, the larynx with its attached goitre then moves upward. **Palpation** shows us the consistency of the tumor, whether the skin is movable, and whether the tumor is movable on the lower strata. If it is immovable, either an acute inflammation of the goitre has set in or we have to deal with its malignant degeneration.

Laryngoscopic examination shows the condition of the glottis as well as of the walls of the trachea. A probatory medication with **thyroid tablets** would be of some use only in exceptional cases. Very frequently there is a bruit over the vessels, or the goitre pulsates. One general symptom we have not mentioned yet, that is, a frequency of cretinism among goitre patients. It is explained by and is parallel to cachexia strumipriva, as disease of the thyroid gland produces symptoms similar to those of its entire absence.

Cretinism.

(2) **Basedow's or Graves' disease** is in close connection with the diseases of the thyroid gland. It has been generally accepted that it is due to a **hypersecretion** of the thyroid gland, thus forming a contrast to myxœdema, which is produced by the absence of the secretion of the gland.

The principal symptoms of Basedow's, if well developed, are:

1st, exophthalmos.

2d, vascular struma.

3d, tachycardia.

The exophthalmos is accompanied (1) by Graefe's symptom: the upper lid does not readily follow the movements of the eye in a vertical direction; 2d, Stellwag's symptom: diminution of the motion of the lid, and, 3d, Moebius' symptom: weakness of the muscles controlling convergence.

The struma is very frequently soft, compressible, and pulsates; vascular râles and vibration are audible and tangible over it. All arteries of the body pulsate strongly. Tremor of fingers and hands, fits of excitation and depression, profuse diarrhœa and excessive perspiration are frequent. Sometimes the galvanic resistance of the skin is reduced. Striking emaciation is frequent, abnormal pigmentation of the skin or œdema less so. Sometimes a violent progression of all these symptoms is observed in the acute forms of Basedow's disease. Other symptoms.

If goitre exerts a strong pressure on the sympathetic nerve, it may offer difficulties in **differentiating** it from Graves' disease. An **operation** is to be recommended only after medical treatment has shown itself without effect, and only in severe cases, but then before the patients become cachectic. The results of the operation so far are, 52 per cent of patients improved, 28 per cent cured, 6 per cent unimproved, and 14 per cent died during or immediately after the operation. Statistics.

INJURIES AND DISEASES OF LARYNX AND TRACHEA.

INJURIES OF THE LARYNX AND TRACHEA.

By far the most frequent injuries of the larynx and trachea are **fractures**, usually the result of an **accident**, as a fall, where the patient strikes the larynx in falling against the edge of a table, or by the patient being run over by a vehicle; or inflicted by strangulation, a kick with the Fractures.

foot, etc. Hanging very rarely produces fracture of either the larynx or the trachea.

The symptoms are: severe **coughing,** frequently producing bloody sputum, and **pain** while speaking, coughing, and swallowing. The patients are entirely aphonic or very hoarse. **Respiration** is either at once or after a short while very **labored,** combined with stridor. The face becomes cyanotic, and besides œdematous infiltration, emphysema of the tissue is observed, which may advance into the mediastinum, pleura, and interstices of the lung. The **deformity** observed consists in a flattening or broadening of the region of the larynx, or defects in continuity are observed. Abnormal mobility and crepitation are present. The laryngoscopic examination can usually not be carried out, as the patients are too dyspnœic. A prompt diagnosis is of importance, as it insures tracheotomy in time.

Wounds of the larynx and trachea are usually self-inflicted or the result of a criminal assault.

Vessels rarely cut.

It has been mentioned above that the larger vessels are rarely severed by a cut across the trachea. Nevertheless the **hemorrhage** is severe. The diagnosis is self-evident, except in cases in which the outer wound is very small.

Other injuries are burns, which occur by inhalation of flame, hot air, or steam.

Foreign Bodies in the Air-Passages.

The presence and localization of a foreign body may be very hard to establish, the anamnestic data usually being of no value or hard to get, except that an apparently perfectly healthy person suddenly shows the symptoms of **suffocation.**

According to the **site** of the foreign body, the symptoms may be very different. Immediately after the aspiration of the foreign body a violent fit of **coughing** usually sets in, which quite frequently throws it out. If this is not the case, small objects, like beans, beads, needles, buttons, etc., may be thrown about violently in the larynx until they become **wedged,** where they either occlude entirely the air-passage, thus producing quick suffocation, except for immediate tracheotomy, or the symptoms may subside for awhile, and the patients be comparatively comfortable. These are the cases in which it may be more difficult to decide whether a foreign body is really present. Laryngoscopic ex-

amination is then usually possible, but even if so, it may not show the presence of a foreign body.

The farther down a small object wanders, the less severe the symptoms usually are. Examination by **X-rays** may prove of value, though it cannot be depended upon with absolute certainty.

Inflammation of the Larynx and Trachea.

Inflammations of the air-passages are of interest to us only in so far as they lead to **stenosis** necessitating surgical interference through **intubation** or **tracheotomy.**

Diphtheria.

By far the most frequent source is **laryngeal diphtheria.** Its diagnosis has been made easy and certain by the discovery of the diphtheria **bacillus**, the presence of which has to be proven in individual cases by bacteriological examination. The attempt to differentiate between croup and diphtheria has been given up.

Symptoms.

In **milder forms** of diphtheria a whitish or dirty gray coating develops on the dark-red tonsils, uvula, and fauces, which may first appear in the form of different specks that soon run together and may cover the posterior wall of the pharynx, the nose, and the larynx. In milder cases the temperature rises only a little.

In the severe **malignant septic** forms the violent general symptoms indicate the seriousness of the condition. The **lymphatic glands** of the neck become infected soon and are very tender. The parts affected by the diphtheritic process become speedily (on the first to third day) **gangrenous,** so that instead of the coating we see extensive, easily bleeding, bad smelling ulcers. The **temperature** is excessively high or subnormal. The pulse grows bad rapidly and the patients are comatose. Serious effects on the **kidneys** accompany the clinical picture.

Stenosis.

The development of stenosis has been divided into **three** different **states.** The **first,** represented by hoarseness and coughing, the latter being of a peculiar barking character, which has been described as pathognomonic for diphtheria. In the **second** state coughing and voice lose more and more timbre up to complete aphonia. Now inspiration begins to be accompanied by **stridor,** a sound, increasing with the progress of the disease, of a grating, sawing, or crowing character. After a short pause, expiration follows, which is very little interfered with. During inspiration the working of the accessory respiratory muscles can be observed. With increasing stenosis the soft parts of the thoracic wall

are drawn inward. The cyanosis increases, the expression of the face becomes more and more anxious, finally reaching the frightful terror of suffocation.

The **third** stage is characterized by the height of cyanosis, the result of a poisoning with carbonic acid gas. This intoxication produces deceptive moments of quietude which precede somnolence. The formerly red or blue face becomes pale, cold sweat appears, the veins of the neck are filled to their utmost, under increasing asphyxia, pulse and respiration stop.

Differential diagnosis cannot offer many difficulties, the only thing to be considered might be foreign bodies, or inflammations other than diphtheritic. In full-grown persons diphtheria might be overlooked, as one is not so apt to think of it.

When to operate.

The indications for **surgical interference,** through intubation or tracheotomy, are governed by the appearance of symptoms of stenosis. It may become necessary at an earlier stage as a prophylactic measure in cases which cannot be watched constantly, but in all cases it should not be deferred too long.

In some cases **secondary** tracheotomy becomes necessary, if decubital ulcers have resulted from intubation, producing the same symptoms of imstenosis as the original diphtheria.

Other inflammatory diseases.

Other inflammatory diseases, as laryngeal œdema, submucous laryngitis, perichondritis, may produce symptoms of stenosis, which are of portance to the surgeon.

One condition ought to be still mentioned, though it rarely needs interference, viz., **pseudocroup** of children, the course of which is typical. It is characterized by **sudden attacks,** in contrast to the slowly developing cyanosis in diphtheria. The attacks occur in the first hours of the night. After an hour or so, the children sleep quietly again and seem to be perfectly well the next morning. In the following night usually a second attack ensues; rarely a third one. There is a tendency to recurrence.

Of the **nervous affections** of the larynx only the bilateral **posticus paralysis** is of surgical interest. It is usually due to tabes dorsalis. The dyspnœa is purely inspiratory, but the voice is not affected at all. Laryngoscopical examination shows an extremely narrow glottis in a position at rest; during inspiration the cords touch. In a number of cases this condition has necessitated tracheotomy.

Other diseases producing stenosis or occlusion of the larynx are syphilis, tuberculosis, scleroma, and neoplasms.

It ought to be mentioned that the stenosis of the larynx and trachea may need in less acute forms other surgical treatment than tracheotomy or intubation, as dilatation by different methods or plastic operations.

Tumors.

The tumors of the larynx and trachea are benign papillomata, usually multiple, and showing a great resemblance to condylomata acuminata. **Papillomata** usually attack patients in early life. The principal symptom is hoarseness. Interference with respiration is comparatively rare. A diagnosis has to be verified by laryngoscopical examination. While they have a decided tendency to recurrence, they are absolutely benign.

Cancer.

The **malignant** growths are represented by sarcoma, which is comparatively rare, and carcinoma, which is quite frequent. They occur most frequently between the ages of fifty and sixty; next in frequency are the years from forty to fifty.

The **diagnosis** in very fresh cases may be quite difficult, for the laryngoscopic picture in the mirror is under life size. The microscopical examination of a probatory excised piece will usually establish a diagnosis, but in a number of cases the clinical aspect of the case has to be taken into consideration. An early diagnosis is very important, and radical surgical measures are to be recommended.

INJURIES AND DISEASES OF THE CHEST.

INJURIES OF THE CHEST.

Injuries of the chest may be produced by:

1st. Blunt force, resulting in **contusion** or **concussion** of the thorax, affecting either the walls of the chest alone, or including the viscera of the thorax.

2d. They may be the effect of **wounds** either superficial or penetrating, however these injuries are brought about.

The important point for practical purposes is, whether the contents of the chest—pleura, lungs, or vessels—are injured or not.

The **architecture** of the chest-wall is such that it can bear great **pressure** if the force is applied **slowly** and under the proper precautions. Show-men, for instance, achieve remarkable feats in carrying from seven to nine hundred pounds on their chest, and, on the other hand, by slow pressure after expiration the point of the sternum can be brought to the spine without any injury. The contusions, compressions, and concussions of the chest are the result of the **sudden** application of great force, as blows, kicks, falls, explosions, cave-ins, run-overs, etc.

Chest can bear great pressure.

The clinical picture of concussion of the thorax is very indefinite when, after a blow upon the chest, no hemorrhage, no fracture, no abnormal dulness, no injury to the lungs or heart, can be found. It has to be looked upon as a **reflex condition** similar to the effect of Goltz's experiment on the abdominal wall. Such concussions may end fatally at once or pass by.

Concussion of thorax.

Contusions of the chest may show all different grades, from such where only the soft parts are concerned, to fractures of the ribs and sternum without any penetration, and to crushing of the chest, where the fragments are dislodged inwardly, injuring the contents of the chest.

Contusions of the **soft parts** show the same symptoms as in other parts of the body, as swelling, ecchymosis, and hæmatoma.

Fractures of the Ribs and Sternum.

A simple and non-penetrating fracture of a rib does not show all the characteristic symptoms of other fractures. A **deformity** caused by deviation of the fragments can be observed only when one rib has been fractured in several places, or when a number of neighboring ribs have been broken. The deformity then consists in a flat depression. **Abnormal mobility** and **loss of function** may then be noted, the latter by the fact that the depressed fragment does not follow exactly the motions of the thorax during inspiration and expiration. **Crepitus** can usually be found. The most obvious subjective symptom is severe **pain** at the seat of the fracture. As to its localization we have to consider this: a pair of ribs with the interposed sternum and spine represent a barrel-hoop, which on compression need not break at the fulcrum where the force is applied. We therefore quite frequently find the rib breaking at a **distant point.** In examination for such fractures we frequently imitate the manner of the accident; compression of the chest by two flat hands in opposite directions produces acute pain and sometimes crepitation at the point of fracture. The same holds good for fracture or separation of the **cartilaginous** parts of ribs.

Fracture of ribs.

Infractions of the ribs are rare, and usually are really fractures without any displacement.

Dislocations of the ribs, either of their double joints at the spine, or at the costosternal articulation, are exceedingly rare, and the former will present unusual diagnostic difficulties, as they are covered by the thick masses of the longitudinal muscles. In all cases of fractures of the ribs **X-ray** photographs will prove of value. Another symptom has to be mentioned: The patient, to avoid pain, **breathes superficially,** a deep inspiration causes coughing. **Crepitation** may be heard more distinctly with a stethoscope; the sound must not be mistaken for the crackling sound of emphysema or the grating sound of a pleural exudation.

Dislocation of ribs.

To determine which rib has been broken, the following may be of service:

To determine which rib is broken.

1st. The scapula covers the second to the seventh rib; the breast of a virgin overlies the third to the sixth rib.

2d. The tip of the elbow touches the middle of the ninth rib if the upper arm is approximated to the side.

3d. The nipple is situated over the fourth rib.

If one or several fragments of a fractured rib have **penetrated** the pleura alone, air enters the pleural sac, producing **pneumothorax;** at the same time blood usually enters, resulting in **hæmothorax** or hæmo-pneumothorax. If the tearing of the inner leaf of the pleura permits hernia of the lung, a **pneumatocele** follows. **Emphysema** is the result of escaped air from the lung into the surrounding tissue. This is more frequent if the lung itself has been injured. The diagnostic points of these injuries will be dealt with later on (see page 95).

Fractures of the sternum are usually produced by direct force, as a hard blow, kick by a horse, heavy fall, run-over, crushing, etc. Besides the direct force, indirect force may be responsible for this injury, by overstretching of the spine backward, where the rupture is the result of tension. Besides that, fractures of the sternum happen during birth. Other causes are coughing and sneezing.

Most of the fractures occur at the junction between the manubrium and corpus.

The principal symptom is spontaneous **pain** as well as on pressure, pain caused by breathing and any motion. If a **dislocation** occurs, the distal fragment moves upward and in front of the proximal end. If the ensiform process is broken off, we find, besides the symptoms mentioned above, abnormal mobility.

Wounds of the Thorax.

Wounds of the thorax are the result of burns, chemical or otherwise, shot, cut, thrust, etc. If they are **non-penetrating,** they do not offer any special characteristics, except that the direction of the inflicting instrument, splinters, daggers, balls, etc., may be deviated by striking a rib. There is a general misconception that a revolver-ball may follow the entire course of a rib, thus encircling the thorax; this is not true. A ball may be **deflected** from its original course, following a rib in a tangential direction, but no more; and will then lie buried under the skin, or make its exit.

Course of revolver balls.

The most important symptom of a wound of the thorax, if present, is **hemorrhage.** The largest artery which may be injured is the **arteria mammaria interna,** which may, if a diagnosis is possible, call for ligation. Less serious is the hemorrhage from the **intercostal** arteries, which may occur as a result of an accident, or during operations, such as resection of ribs or thoracotomy, or even simple aspiration.

There has been much controversy whether gunshot wounds of the thorax, penetrating or not, are to be considered aseptic or infected wounds. As a rule it is safe to assume that they are not infected, even if particles of clothing are carried along. Certainly refraining from examination with the probe, as mentioned in the Introduction, cannot be recommended too strongly. Are shot-wounds of thorax infected?

Of the penetrating injuries and wounds of the chest the **perforation of the pleura** is by far the most important one, much more so than the wounds of the lungs.

If **pneumothorax** is well developed, percussion shows the characteristic tympanitic sound, which increases with the size of the wound in the wall, and the time during which air enters. Frequently respiration becomes irregular, intermittent, and labored. With the dyspnœa the pulse becomes feeble, intermittent, and accelerated.

Hæmothorax and **hæmopneumothorax** may be the result of bleeding from the outer wound as well as from the pleura and lung. They produce severe **symptoms of pressure.** The compressed lung recedes and cannot take part in breathing, a state which is lasting as long as the wound in the pleura is open. As soon as it closes, either by spontaneous coagulation, by tissue autotamponade, or by therapeutic measures, the collapsed lung is blown up again by inspiration, and restitution takes place in a short while.

A **pneumatocele** can usually be seen, and shows a part of the lung incarcerated, which becomes inflated with the expiration. In the later stages the part of the lung affected may become gangrenous.

Subcutaneous emphysema, as mentioned above, may result from pneumothorax without injury to the lung, if the air contained in the pleural sac is pressed into the surface tissue. In a higher degree it develops if the lung is wounded. Its **characteristic symptom** is the puffy swelling of the parts affected, which gives to the examining finger and ear the feeling and sound of crackling snow. On pressure it can be pushed forward like œdema. Emphysema, even if immensely developed, may subside after a comparatively short time without serious results. This was so in a case I observed when an elderly woman, being thrown against the railing of an ocean steamer by a heavy sea, fractured eighteen ribs. On the fourth day the woman looked like a balloon. She recovered. Subcutaneous emphysema. Case.

The most constant symptom of an injury of the lung is **hæmoptysis,**

coughing up of blood. Through the penetrating wound very often not only air escapes, but foamy blood.

Perforating wound.

The results of a perforating wound of the chest may vary if the two layers of the pleura are **adherent,** a fact very frequent after the patients have experienced any disease of the lung or pleura in former life. It is easy to see that then pneumothorax may be lacking, while only hæmoptysis and emphysema are present.

The anatomical and clinical symptoms of **shot wounds of the lung** vary; the modern rifle-ball of small calibre frequently goes through the entire chest without breaking a rib, only those deflected from their sagittal direction make an exception. Some of those shot with rifles fall down at once as if dead. This is in many cases only the result of shock,

Symptoms.

and the injured person comes to shortly. Other patients hit by a bullet while running, are unaware of it, and keep on running; usually, however, the symptoms are not inconsiderable. The injured person can no longer keep himself erect, becomes pale and trembles, and has an anxious expression of the face; cold sweat covers the forehead, and the extremities become cool, the voice weak, lips livid; irritating cough and labored respiration follow. Respirations are superficial, short and frequent, pulse weak, small and irregular. The patients sometimes complain of violent pain in abdomen and chest, and throw up much blood.

Location of bullets.

As to the location of bullets we have to mention that owing to the high velocity of modern rifle-balls the bullet usually goes through, a fact which is proven if we find a hole of exit. If the bullet, especially from revolvers, does not leave the body, it is very hard to localize and still harder to extract it.

X-ray photographs are of value only if taken en face and in profile. Usually no attempts to locate a bullet should be made, as the presence of bullets is usually borne very well.

If the deeper layers of a penetrating wound of the chest have become **infected** (which is more frequent with dagger wounds than with shot wounds), **empyema** results, and **abscesses,** and possibly **gangrene** of the lung. In the famous case of thoracoplasty of Schede the entire left lung had become gangrenous from an overlooked rubber drain, which was used for draining empyema. In the later course of these injuries the patients frequently develop **tuberculosis**, their resistance against this invasion apparently having been impaired.

DISEASES OF THE THORACIC WALL.

Congenital deformities of sternum and ribs are rare. Comparatively most frequent is an abnormal number of ribs, either by decrease or increase. A **supernumerary rib** occurs (usually bilateral) at the seventh cervical vertebra. The symptoms are those of **irritation of the brachial plexus**, viz., neuralgic pains radiating through the entire arm, paræsthesias in form of numb feeling or formication (feeling of running ants). The **function** of the arm may be greatly impaired, although paralysis has not been observed. The diagnosis is easy: instead of the normal cavity above the clavicle we find a bulging lump, which presents **pulsation** to the eye and touch. The pulsation comes from the subclavian, and the **bulging** is produced by a bone-hard tumor the width of a finger above the clavicle. The tumor is immovable, painless, and covered by normal skin. The symptoms may be increased by carrying heavy loads on shoulder-straps. The **differential diagnosis** has to take into consideration only exostosis of the first rib, which may produce similar symptoms. The *x*-ray picture is of great value. The diagnosis is important, as resection of the supernumerary rib relieves the patient at once. Diagnosis.

Acquired deformities of the thorax are due either to rickets or to deformities of the spine, produced either by organic or static diseases of the same. Cf. Spine.

Inflammations of the Thoracic Wall.

Furuncle and carbuncle of the back show no symptoms differing from those already mentioned under the carbuncle of the neck. A place of predilection for carbuncle is the back, only that of the neck being more frequent. The carbuncle of the back is always to be considered a **serious** affection. It is of much larger size than one would expect from the comparatively small central area. It forms a cone with a very broad basis, as the operation of extirpation shows. It has a great tendency to attack the **deeper tissues** and quite frequently muscles, fascia, and neighboring bones are destroyed. It is more frequent in elderly people, and is very often due to diabetes. Early operation is strictly indicated. Carbuncle.

Phlegmons of the thorax are rare, but must not be overlooked, as they have a tendency to spread over large areas, so that the septic infec-

tion may prove too much for the patients. They usually start from suppurative glands of the axilla.

Abscesses of the thorax may either start from the soft parts of the wall of the thorax, or be due to perforation of abscesses from within, like empyema, pleuritic abscesses, or abscesses of the lung.

Diseases of the Ribs and Sternum. Osteomyelitis of the ribs is not so rare as has been assumed; typhoid fever is especially responsible in a number of cases for this infection. It is usually localized at the anterior end of the ribs. The clinical symptoms are those of any other osteomyelitis.

Tuberculosis.

Tuberculosis of sternum and ribs is quite frequent, and usually occurs in middle life. It may start either from a focus in the bone itself or from the periosteum. **Fistulas** usually form after a short time, the pus and granulations always breaking through to the outer wall, and very rarely only inward. If fistulas are in existence, the probe finds the raw bone without difficulty, except in cases of burrowing abscesses. The granulations and wall of the fistula show the typical tubercular appearance.

Syphilis.

Syphilis of the ribs and sternum is not rare in the **tertiary** period. It starts from the periosteum, and shows in the rib a spindle-like tumor of large size, which may be mistaken for other tumors.

For **differential diagnosis** it is said that the syphilitic pus is more stringy and homogeneous, while the tuberculous abscesses show more caseous, flaky contents.

Actinomycosis.

Actinomycosis of the wall of the thorax can be diagnosed with certainty only when the typical **druses** containing the radiate form of actinomyces have been found with the microscope. It is enough to suspect actinomycosis from the **irregular formation** of multiple abscesses, the microscopical examination must do the rest. They either have a tendency to grow inward toward the lungs, or are the result of a perforating growth from within outward.

Intercostal neuralgia.

Intercostal neuralgia is either a **primary** affection of the intercostal nerves after colds or acute infectious diseases, or the **result** of deforming processes of the spine. The pain is usually confined to one side, but several nerves are generally affected. The **pain** starts in the back and follows the course of the rib. It may be so severe that the patients are afraid to breathe. Surgical interference, as stretching of the exposed nerves, or resection of the same, is therefore indicated and has given good results.

Tumors of the Wall of the Thorax.

The entire series of benign and malignant tumors may occur in the wall of the thorax.

Nævi are quite frequent on the back and chest; very often they are dark brown and covered with hair. They require surgical interference by extirpation or treatment with *x*-rays, purely for cosmetic reasons.

Atheromas and **dermoids** are quite frequent, still more so the **lipomas,** which sometimes reach extremely large size.

Of interest are the keloids, especially the keloids developing on **scars.** Keloids. They represent a thickening and hardening of a formerly normal scar, producing a tense ridge with knobby surface of pale red or grayish color. A special individual predisposition seems to be necessary for the formation. They are very frequent after **burns.** In spite of their absolutely benign fibromatous character, they show a great tendency toward **recurrence** after extirpation, from which fact the rule has been derived to leave them severely alone.

Besides the simple **fibroma, fibroma molluscum** may be observed. It starts subcutaneously from the sheath of the nerves; is soft, and is always multiple.

The **enchondromas** of the ribs and sternum are closely related to the sarcomas; and for their tendency to assume a large size and grow into the depth, their early extirpation is indicated.

Of the **malignant** tumors, both sarcoma and carcinoma occur, the Cancer. latter being usually secondary. A superficial scirrhus of the mamma sometimes involves large areas of the chest-wall, and is then called cancer *en cuirasse.*

DISEASES OF THE BRONCHI AND LUNGS.

In **bronchiectasis** (bronchial dilatation) we distinguish the cylindrical and saccular bronchiectasis, the former being usually multilocular. They are of less surgical interest. Great bronchiectatic **cavities** near the chest-wall give the physical signs of lung cavities, tympanitic sound on percussion, change of sound with opening and closing of mouth, bruit de pot fêlé (cracked-pot sound). Extensive gangrene causes dulness on percussion, and we hear bronchial respiration, numerous moist râles. A gangrenous cavity gives a tympanitic sound on percussion, amphoric respiration, moist râles. The expectoration is usually very abundant Nature of sputum.

(mouthful expectoration), especially in the morning. It usually has a stale, sweetish odor, but may be fetid. On standing it exhibits a distinct division into **three layers**: an upper frothy muco-purulent layer, a middle muco-serous, and a lower purulent layer. **Pulmonary hemorrhages** are not infrequent; characteristic of them is the constant absence of tubercle bacilli and of elastic fibres. The **differential diagnosis** from abscesses of the lung, which have perforated into the bronchus, is based on anamnestic points.

An **operation** is indicated, if the disease is only unilateral, if large cavities are proven beyond doubt to be superficial, and if the secretion is stagnating.

In cases of **multiple** bronchiectasis, resection of several ribs without opening of the pleura, to permit sinking of the chest-wall and the affected lung-parts under it, may be indicated.

The risk of the operation is still very great. **Mortality** amounts to twenty-five per cent, a percentage almost contraindicative, as patients with bronchiectasis in many cases reach great age.

Gangrene of the Lung.

Gangrene of the lung develops most frequently immediately after pneumonia; it may be either circumscript or diffuse.

Symptoms. In pneumonia patients the suspicion of gangrene is justified, if the **expectoration** becomes more abundant and of repulsive penetrating **odor,** if the temperature rises again, and coughing increases. The penetrating stench of the copious sputum is **characteristic.** It settles in three layers; the lowest one containing grayish yellow and sometimes pigmented long shreds of lung, which shows under the microscope the constituents of the parenchyma of the lungs—a decisive factor in distinguishing between pulmonary gangrene and simple fetid bronchitis. Profuse hemorrhages of the lung are rare. Physical examination gives signs of infiltration or cavity formation. The localization is much more difficult, also the decision whether the focus is solitary or multiple. Proof of cavernous symptoms and radiography are of value. **Probatory puncture** is strongly **contraindicated,** because of the danger of infection of the pleural cavity. If circumscribed gangrene is diagnosed with certainty, pneumotomy is indicated.

Odor of sputum.

Diagnosis. If the symptoms of cavity formation are lacking, the diagnosis can be verified if:

1st. We find a circumscribed dulness, especially in the lower lobe, which is surrounded on all sides by normal lung-sounds on percussion.

2d. If abundant parenchyma shreds are found in the sputum expectorated.

3d. If the radiogram shows a shadow exactly at the point indicated by physical examination.

Obstinate high fever with chills necessitates **operation,** even if the focus is not very superficial; and complicating empyema requires immediate interference. Adhesion of the two pleuras improves the chances of operation.

The **prognosis** is the better the sooner the operation is done. The percentage of mortality is forty. If cure ensues, it is complete and **lasting.**

Abscesses of the Lung.

Abscesses of the lung produce **general** and local symptoms; of the former the most important one is the practically continuous **fever.** If an abscess is the result of pneumonia, high temperatures either keep right on or set in again after the crisis. At the same time, or soon afterward, copious, putrid, cream-like **secretion** of sweetish odor is evacuated *per os* in jets. The **microscope** shows numerous elastic fibres, shreds of parenchyma, as long as an inch or more, crystals of hæmatoidin and of fat. Symptoms.

Physical symptoms of cavity may develop only during the course of observation. Of special importance is the **change of the percussion sound** after copious expectoration. If the walls of the abscess collapse, cavity symptoms are lacking. If after pneumonia a circumscribed dulness exists, surrounded by normal lung-sound, if the expectoration is very copious, putrid, accompanied by constant fever, and if the radiogram shows a shadow at the place of dulness, an abscess is highly probable. Diagnosis.

Operation is indicated without delay, as soon as the presence of a solitary acute abscess or a number of neighboring abscesses in one lobe, which do not heal spontaneously in the normal time (from three to ten weeks), is established. If we find adhesion of the pleuras, the operation is easier. **Puncture** of the abscess is strongly **contraindicated.**

The **results** of the operation are 73 per cent cured in acute cases, 27 per cent mortality. In chronic cases 51 per cent cured, 23.5 per cent improved, and 25.5 per cent dead. In a number of cases the abscess heals spontaneously after perforation into the bronchus.

Tuberculosis of the Lungs.

If we can prove, with some probability, a tuberculous affection of advanced degree confined to one upper lobe, immobilization of that part by thoracoplasty is worth trying, and permitted according to the present state of our knowledge.

Echinococcus of the Lung.

The varying and indistinct symptoms of echinococcus can be correctly interpreted only when the echinococcus **cysts** are coughed up, or at least when parts of them, like the membranes or the hooklets, are found in the expectoration, or in the fluid gained by probatory puncture.

If the **fluid** is as clear as water, free of albumin, but rich in chloride of sodium, the **diagnosis** is certain. Sometimes echinococcus in other organs exists at the same time.

Operation. Opening of the sac by pleurotomy or pneumotomy is indicated if echinococcus has been proven and located, if not situated too deeply; if the sac has suppurated, operation ought to be done as early as possible.

Operation has still to be considered a very serious one. Without operation there is a **mortality** of about sixty per cent.

Actinomycosis of the Lung.

Clinically it may show the exact symptoms of tuberculosis of the lungs. The **differential diagnosis** becomes certain only by the microscopical proof of the presence of actinomyces. This is possible only when the **skin** of the thorax over the affected area shows actinomycosis. Until the process has grown through the wall, the affection of the lung must have made such progress that the **prognosis** of surgical interference cannot possibly be very good. Nevertheless, opening and scraping out of abscesses has effected a cure in some cases.

DISEASES OF THE PLEURA.

Pleurisy and Empyema.

Although the occurrence of primary pleurisy has been claimed, pleurisy is either a **secondary** disease, propagated from diseased neighboring organs, as the lungs, mediastinum, or subdiaphragmatic abdom-

inal organs, or it is a **metastatic** result of severe general infectious diseases, like acute articular rheumatism, diphtheria, etc. Besides that, it may be the result of general dyscratic diseases, as nephritis, gout, scurvy; in this latter case it is more correctly called **hydrothorax.** Only the pleuritic effusion is of surgical interest. Of the **clinical symptoms** the pleuritic pain is most frequent. Its intensity need not be parallel with the extent of the disease. **Coughing** is very frequent and, like the **pain,** intensified by deep inspiration. There is only scanty expectoration. Respiration is usually shallow and frequent. Fever mostly accompanies pleurisy, but is usually not very high; the pulse is commonly a hundred or more; in some severe cases its strength and tension are much diminished.

Pleuritic effusion.

The amount of **urine** is decidedly diminished as long as the effusion increases or is stationary. The total amount for twenty-four hours is sometimes not over eight or ten ounces, of high concentration, about 1024 to 1028.

An effusion of 250 c.c. in adults, of 100 c.c. in infants, can be proven by percussion. Dulness on percussion shows differences, if the exudation has taken place while the patient was up and about, or lying flat on his back, or on the affected side—the latter a position frequently assumed by patients as least painful. In **ambulatory** cases the dulness reaches its highest point next to the spine, and sinks toward the axilla. If acquired with patient in **dorsal** position, dulness may be found only in the back; in **lateral** position it reaches as high as the axillary line.

Effusion varies according to position of patient.

Large exudations displace the heart and liver. An **important symptom** is the increased size of the affected side of the chest (it has to be remembered that the left side is normally a quarter to a half inch smaller than the right). Changes in dulness in pleuritic effusions may occur with the changes in the patient's position, but are absent if adhesions have formed.

Auscultation always gives a **diminished respiratory** murmur over the pleuritic effusion, which first sounds vesicular, later on, bronchial. The pleuritic friction sound is present only at the upper boundary, where the two pleural surfaces meet.

Auscultation.

On auscultation, the voice sounds bronchophonic and sometimes bleating. In clear effusions whispering can be heard distinctly through the thorax, but not in empyema (this does not hold true in all cases). Vocal fremitus is always diminished, in marked cases entirely absent.

If pyogenous bacteria invade the pleural fluid, it becomes purulent

Empyema.

and empyema ensues. The nature of the exudation can only be ascertained by probatory puncture, which ought to be applied in every case (with the usual precautions).

Indications for Operation.

Serous effusions ought to be emptied by aspiration when the life of the patient is in imminent danger, or if the fluid does not become absorbed. If possible, evacuation should not take place too soon, as the pleuritic sac will then only fill again. The operation is not without great danger, especially if too large quantities are emptied suddenly.

In empyema, the only proper operation is resection of one or two ribs, followed by drainage. It is to be performed as soon as presence of pus has been established, except in children, where the indication is not so stringent. It is contraindicated in empyema with florid phthisis.

Case. In case of **total empyema** of long standing, where the lung is completely compressed and retracted toward the hilus, Delorme's operation is indicated, which is an extensive thoracoplastic procedure, that permits the sinking-in of the door-shaped opening and removes at the same time the pseudo-membranes of the lung, permitting its expansion. I subjoin photographs of one of my cases (Plates 7 and 8), in which I operated for total empyema of twenty-one months' standing. The marked scoliosis is partly the result of neglect, as the case escaped my observation for over a year after operation.

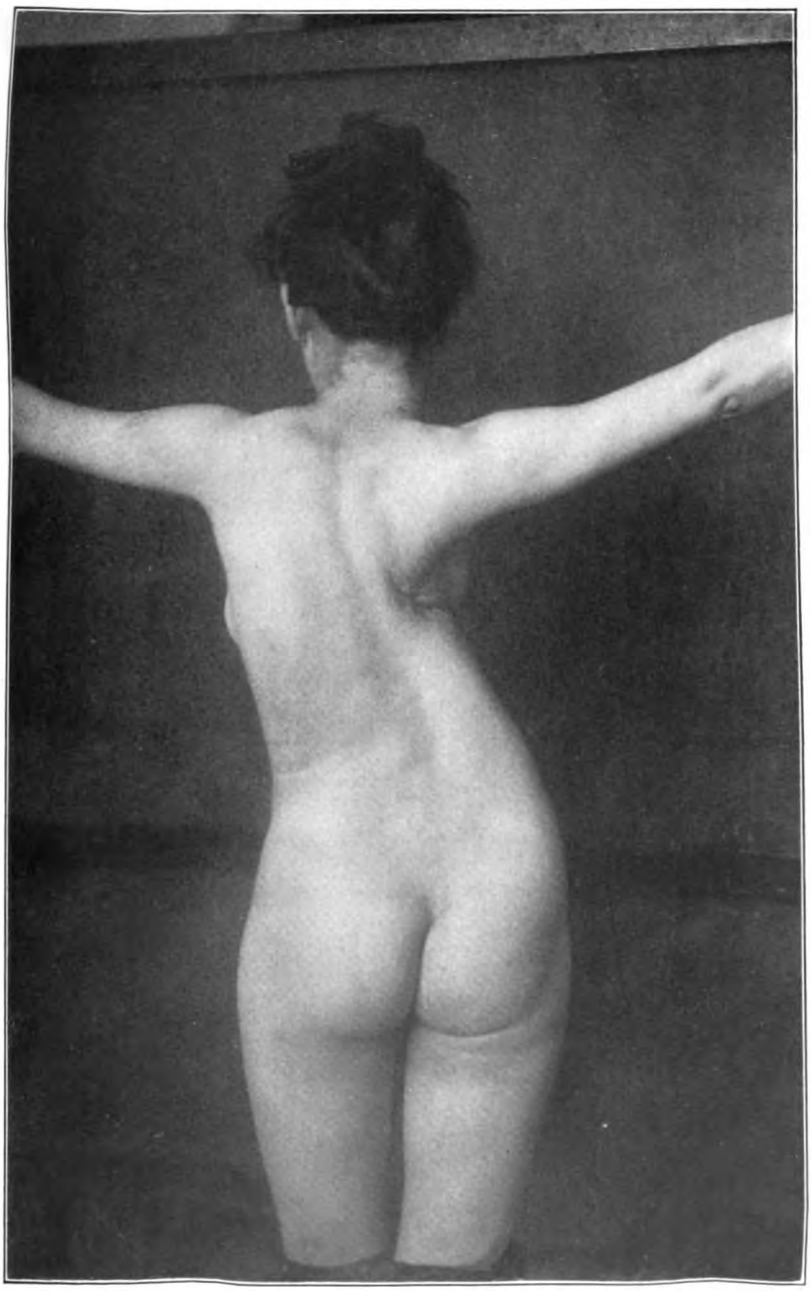
Tumors of the Pleura.

Endothelioma; inoperable. Of these only endothelioma is of importance. The symptoms are those of pleurisy; radical treatment is impossible; only symptomatic treatment, as evacuation of the secondary effusion, is feasible. Even that is to be postponed as long as possible.

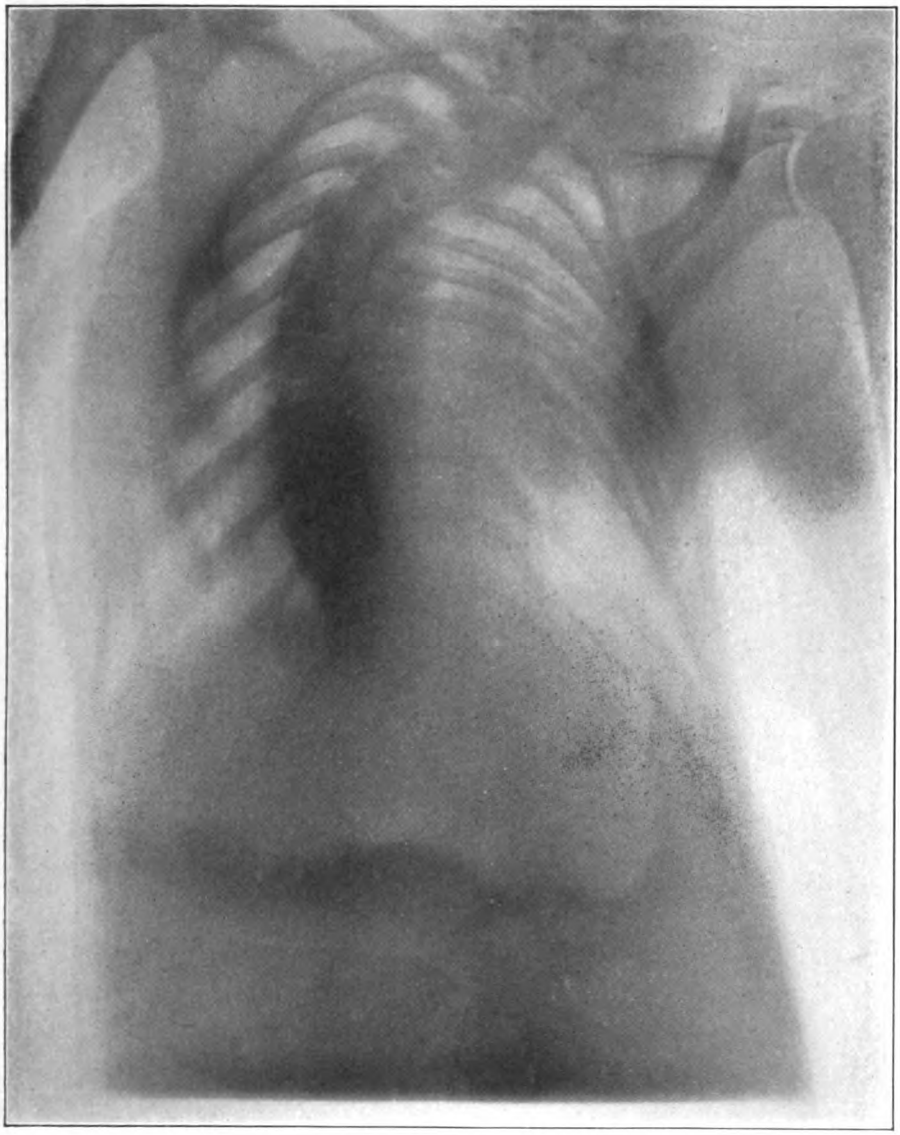
DISEASES OF THE MEDIASTINUM.

Suppurative Inflammation of Mediastinum.

It is due to **propagation** from an **inflammation** of neighboring organs, or to **metastasis,** or to **trauma**. Tuberculous infection is the most frequent, next, by pus progressing from the neck, or mouth, or spine.



RESULT OF DELORME'S OPERATION FOR TOTAL EMPYEMA of twenty-one months' standing. Photograph taken two years after operation. Note scoliosis.



RESULT OF DELORME'S OPERATION FOR TOTAL EMPYEMA.
Skiagram of Patient shown in Plate VI.

Lues, erysipelas, and typhoid may produce metastases. Apparently the collection of pus in the anterior mediastinum is greater than in the posterior.

The symptoms of this comparatively rare disease are, besides those of the original disease, **pain** of a **pulsating** character; the sternum becomes tender and its integument red and œdematous. The radiogram shows an enlarged shadow. Dulness in the first and second intercostal space. Besides this, symptoms are observed which are due to the compression of the neighboring organs, the trachea, œsophagus, recurrent nerve, and heart. Symptoms.

The **indication** for **operation** is given as soon as it is possible to prove the probability of suppuration of the mediastinum. Even if the operation as such is a success, the disease may lead to death.

Tumors of the Mediastinum.

They may be primary or secondary.

Only the **primary tumors** are of surgical interest, for obvious reasons, and of these, especially the benign tumors which are, however, rarer than the malignant ones. The benign tumors are endothoracic strumas, dermoid cysts, fibromas, and lipomas.

The symptoms are somewhat similar to those of inflammation of the mediastinum. Of **local symptoms** we have to mention enlargement of the veins of the anterior thoracic wall, sometimes œdema. The tumor is occassionally palpable from the jugulum; an **intrathoracic struma** is nearly always connected with the upper struma by a cord which can be clearly felt. The compression symptoms are the same as mentioned above. **Pleural effusion** has been observed frequently; also bulging of the thoracic wall, especially with dermoids. Symptoms.

Dermoids can be diagnosed either by **probatory puncture** (with not too fine a needle), or by examination of the secretion of a freshly established fistula, in which the contents of the dermoid are then found. Dermoids.

Great difficulty exists in **differentiating** these tumors from aneurism or circumscribed empyema.

The **operation** is indicated as soon as the diagnosis of a benign tumor can be made out with any probability.

The **risk** of the operation is, because of the locality, very great. Nevertheless, quite a number of successful removals of benign tumors are known.

INJURIES AND DISEASES OF THE HEART AND VESSELS.

INJURIES TO THE PERICARDIUM.

Injuries to the pericardium alone, not involving the heart, are possible and have been observed, but only by rare accident the pleura is not injured at the same time. If no serious hemorrhage into the pericardial space takes place, the **symptoms** are so slight that a diagnosis is impossible and the prognosis very good, unless **pericarditis** ensues through infection, which may not make itself apparent until even a month after the injury.

But in the more frequent cases where **hæmatopericardium** is formed, the manifold symptoms of compression of the heart, also called heart tamponade, are very striking. The heart becomes highly excited, its beat irregular and intermittent; dangerous dyspnœa, and frequently death soon results.

Diagnosis. A sure diagnosis is practically impossible, especially in the beginning. The principal aids are the hæmatopericardium and the site of the outer wound. The **sounds** of the heart are frequently hardly audible, or only as from a distance, while in some cases they are normal, according to the amount of blood in the pericardial sac. Distinct friction sound is frequent.

If the pleura is injured at the same time, **pneumopericardium** is formed, indicated by a tympanitic sound.

The **prognosis** is not altogether bad, forty-five per cent of the reported cases having resulted in cure.

The question of **operative** interference, in the form of suture of the pericardium, is still an open one, and tamponade and drainage ought to be recommended as the safer procedure.

INJURIES OF THE HEART.

Wounds of the heart are either superficial or penetrating, in the latter case they open one of the heart cavities. Besides sharp instruments, bullets, fragments of bone, etc., blunt force may be responsible for the

wound of the heart, causing traumatic rupture. The heart can be perforated by a ball without a wound of the pericardium.

Naturally only those cases not at once fatal come to clinical observation. The precise diagnosis is exceedingly difficult. It becomes probable from the situation of the wound, the nearly always present hæmatopericardium with more or less dulness, and dislocation of the heart, the superficial, very frequent respiration of eighty or more, the moving of the alæ of the nose, the paleness, irregular heart's action, anxiety and restlessness, the small irregular pulse, pains in the region of the heart, cyanosis, and frequently the peculiar collapse. Sometimes the outer wound pulsates. In a number of cases suture of the heart has effected a cure.

Diagnosis difficult.

DISEASES OF THE PERICARDIUM.

Pericarditis is analogous to pleurisy. It is most frequently caused by articular rheumatism, tuberculosis, and pleuropneumonia. Besides that, septic infectious diseases may produce pericarditis.

The inflammation may either be dry or result in **effusion** which may be serous, hemorrhagic, seropurulent, or putrid. The quantity may reach 1500 c.c. or more.

The principal symptom is **friction sound,** not entirely synchronous with the action of the heart, depending upon respiration; it is increased by pressure of the stethoscope on the thoracic wall. The dulness over the heart is broadened and reaches the left side over the apex-beat. Frequently, besides pericarditis, pleurisy is present.

Symptoms.

Sometimes a differentiation of **pericardial** sounds from **intracardial** sounds is difficult, if dilatation of the right ventricle exists. In doubtful cases the slow but constant increase of the dulness and the striking incongruence between absolute and relative dulness is decisive.

The **opening of the pericardium** is indicated absolutely, if the heart is in peril of being paralyzed by a large exudation. Even small exudations necessitate operation, if they are of putrid character. Only irreparably developed organic diseases form a **contraindication** for the operation, while the general poor condition of the patient, even if he is apparently *in extremis*, does not prevent the operation, as general narcosis is not necessary.

Indication for operation.

The **risk** of the operation, while great, must not be overrated, about fifty per cent of extreme cases having been cured.

ANEURISMS.

The aneurisms in question, according to their frequency, are in descending order: aneurism of the aorta ascendens, of the arch, of the thoracic aorta, and finally of the abdominal aorta. The aneurisms named first are of interest to us.

Symptoms. **Subjective** symptoms are pain and stenocardiac attacks; the **objective** symptoms are those of compression and displacement of neighboring organs, and the formation of a pulsating tumor.

Striking **accentuation** of the first and second sounds over the course of the aorta and **bruits** are always suspicious for aneurism. **Dulness** in the first and second intercostal spaces beside the sternum, strong **pulsation** in the jugulum, pulsatory lifting of the upper end of the sternum, and pulsation on the right side of the manubrium, are **important** symptoms of aneurism. Paralysis of the left vocal cord or of the recurrent nerve is frequent, also pulsatory circumscript bulging of the wall of the trachea, bronchostenosis of the left side, and pulsating movement downward of the larynx during systole, and more or less pronounced stenosis of the œsophagus.

If the sternum and ribs are eroded, the aneurism protrudes as a hemispherical pulsating **tumor**.

Bronchostenosis (common in sac-like aneurisms of the arch) produces stridor. The vesicular sound of the left lower lobe is diminished and the left lung does not follow in respiration.

Diagnosis. The diagnosis is not very difficult, at least of those cases pronounced enough for operation. A simple atheroma of the aorta does not produce erosion of the sternum. Only vascular tumors may present difficulties for **differential diagnosis**; they have as specific symptoms strongly developed veins of the thorax wall and, if there are malignant swellings of the glands, cachexia and low systolic or diastolic sounds over the tumor. Aneurisms show besides the vibration of the tumor an expansive pulsation.

Strict indication for **operation** is not very easy to lay down. While the disease if left to itself practically invariably ends fatally by rupture, operations do not show much chance for cure, but only for improvement. The aneurism is operable if it is not situated too deep, and if it is adjacent to the chest-wall. The indication for operation will depend on how the patient feels. If the suffering is unbearable, an operation, even with only a slight chance, is permitted.

Subcutaneous injection of gelatin is feasible in all cases, except in presence of nephritis. If the aneurism is bulging out, other vascular changes not too far progressed, and the tumor of the vessel pedicled, acupuncture, galvanopuncture, introduction of foreign bodies, or Brasdor's operation, is to be employed.

OTHER DISEASES OF THE VASCULAR SYSTEM.

Anasarca, dropsy. General **œdema,** due to diseases of the heart and kidneys (not those of cachectic nature), may achieve such dimensions that surgical interference to improve the condition of the patient becomes a necessity.

If diuresis is insufficient and diaphoresis inapplicable, and the condition of the patient requires prompt removal of the œdema, **puncture** of the skin is indicated. Besides this, hydrops, persistent in spite of internal medication, may necessitate puncture of the skin or incisions to relieve the discomfort of the patient.

Indication for operation.

The operation is not without **danger;** too large quantities withdrawn at once may be fatal, even on the second or fourth day. Besides this, frequent scarifications of the skin may possibly hasten amyloid degeneration. The operation very frequently saves the life of the patient, and sometimes is of lasting effect.

VENESECTION.

I wish to include here the indication for venesection, an operation formerly very common, then given up entirely, and now again coming into usage. The purpose of bleeding can be twofold, either to remove toxic products, or to relieve pressure in the vascular system.

Intoxications are treated by venesection if the blood is laden with poison, such gases as hydrogen sulphid, illuminating gas, carbon dioxid, prussic acid, laughing gas, etc. In such cases it is usually to be followed by saline infusion. In **insolation** it is employed to advantage after general medication has failed, and especially if convulsions set in.

When is bleeding indicated?

In acute attacks of **uræmia**, venesection may save life.

In **eclampsia,** liberal venesection is indicated as a preventive measure, as well as after establishment of eclampic convulsions after spontaneous or artificial delivery.

Pneumonia may necessitate bleeding in beginning œdema of the

lungs, if the heart seems to succumb, which is indicated by the second pulmonary sound becoming weaker.

In **concussion** of the brain or fracture of the base of the skull, venesection has been applied with success to reduce the hyperæmia of the brain.

INJURIES AND DISEASES OF THE DIAPHRAGM.

As a **congenital deformity**, a small opening in the diaphragm may exist, which may give cause for the formation of an **epidiaphragmatic hernia** of the abdominal organs into the epidiaphragmatic space. The **symptoms**, if present, are those of intestinal incarceration and can rarely be made out with any certainty.

Rupture. Of the **injuries** of the diaphragm the most frequent, besides wounds, is its subcutaneous rupture. It is either the result of the contusion of the chest, or it may be torn during vomiting, or in labor. Frequently the rupture is the result of a **congenital predisposition.** Any of the organs contained in the abdominal cavity may enter the chest, especially the stomach, part of the colon, part of the liver, the spleen, etc. The only **typical symptom** is the partly involuntary, partly voluntary, cessation of diaphragmatic (abdominal) respiration.

Percussion may disclose tympanitic resonance in the chest.

Surgical **diseases** of the diaphragm are so rare that their description may be omitted.

INJURIES AND DISEASES OF THE MAMMA.

CONGENITAL DEFORMITIES.

In rare cases **supernumerary nipples** and **glands** have been observed; the latter either follow the "mammary line," or are situated on the shoulder, back, over the deltoid, or thigh. During pregnancy the accessory glands swell and hurt. Surgical interference may be desired by the patient for cosmetic reasons, or for relief from inconvenience.

INJURIES OF THE MAMMA.

They show no peculiarities, and the wounds of the mamma, owing to the rich vascularization, heal promptly.

Traumas of blunt force lead frequently to the formation of cysts, and create a predisposition for development of cancer in later years.

DISEASES OF THE NIPPLE.

Fissures of the nipples during nursing occur very frequently. They are characterized by extreme painfulness, preventing further nursing of the child, and very frequently forming a source of infection.

Subacute eczemas, forming thick scabs, deserve the attention of the surgeon, as they may cause, besides the primary infections, the development of **Paget's disease**: under piercing pain the nipple becomes intensely red and presents a finely granulated appearance, as if the epidermal surface had been lost. In some cases the eczema shows a similarity to **psoriasis** or **lupus**; after a course of one year, or one or two years, **cancer** of the gland develops. Eczema.

INFLAMMATION OF THE MAMMA.

In puberty, girls as well as boys show painful **swelling** of the mammary gland, which disappears after two or three weeks. In some cases this inflammation ends in **suppuration.**

A similar mastitis occurs in young girls at the time of menstruation. Subacute inflammation.

Shortly before or after the menopause, some women show a subacute inflammation leading to the formation of nodules and infiltration. By **fibrous degeneration** and shrinking the mammilla is drawn in; the similarity with cancer is evident and has to be kept in mind. This state, without any special treatment, disappears after the lapse of a few weeks.

Puerperal Mastitis.

By far the most frequent and important **inflammation** of the mammary gland occurs during nursing, especially in the first four weeks.

There is a **mild form** of mastitis produced by stasis without any external infection. The breast becomes hard, the skin slightly reddened, and the swollen lymphatic ducts can be traced into the axilla.

The more serious form is caused by inflammation from the surface. Severe form.
It may be either superficial and run its course as **phlegmonous erysipelas,** or attack the **interstitial tissue** of the gland, or the **glandular tissue** itself. High fever is always present, sometimes initiated by a chill. The breast becomes very painful, nursing is impossible, the gland and its integument show all the **signs of acute inflammation**. Later on palpation shows a pit in the gland at the place where suppuration and

perforation will take place. Early **diagnosis** is important to insure prompt incision, even before formation of an abscess. In some cases the inflammation leads to the formation of a milk fistula or cyst.

Sometimes the mastitis becomes **chronic,** forming a number of small and larger cysts, necessitating the **amputation** of the breast in spite of its benign character.

Tuberculosis. Of the **superficial inflammations** of the mamma, tuberculosis is the most important one, which may either develop as a **circumscribed cold abscess** or appear in a more **disseminated form,** with isolated tuberculous nodules which run together later on. The **diagnosis** is the easier, the more advanced the disease is. If fistulas are formed, they assume the typical tuberculous character. **Microscopical examination** will verify the clinical diagnosis.

Mastodynia, Neuralgia of the Mamma.

It is necessary to know that sometimes neuralgic pains occur in the breast, which are intense and of shooting character, without any apparent cause. Frequently **hyperæsthesia** is present. Sometimes disorders of the **genital apparatus** exist, or the pains are due to **intercostal neuralgia,** or indurations of some of the nodules of the glands are to be felt, which prove frequently to be **neurofibromata.** Exact observation is necessary to be able to prove the absence of carcinoma.

TUMORS OF THE MAMMA.

Pure **hypertrophy** of the mamma is always bilateral, and develops either at the time of puberty or during the first pregnancy. Sometimes the breasts assume excessive size.

Fibro-adenoma. Fibro-adenomas of the breast represent the **only benign** tumors of the gland. They cause no pain, and vary in size from that of a hazel-nut to that of a man's head. They are **encapsulated** (and therefore freely movable as long as they are small), dense, and hard, usually of round form and smooth surface. They never become adherent to the skin or the pectoral fascia. The axillary glands do not become involved. Even after long standing they never perforate the capsule.

Sarcoma. Sarcomas occur in **all** different **forms**—soft, hard, and cystic; the latter and the spindle-cell sarcomas grow comparatively more slowly, the round-cell sarcomas very rapidly. All ages, from puberty on, are subject to their formation. The axillary glands are frequently not in-

volved until the very last. Frequently only the **microscopical examination** after extirpation shows the sarcomatous character of the tumor.

Carcinoma of the Breast.

The breast holds the second place in point of frequency as a site for cancer in women, being surpassed only by the uterus. It is never observed until after puberty. Carcinoma of the breast, like all other cancers, is decidedly on the increase. As to the etiology, it is significant that the carcinoma of the breast of sterile women represents only ten to sixteen per cent of all cancers of the breast. Chronic inflammation and mechanical irritation are quoted as etiological factors. Etiology.

Trauma is surely in many cases a predisposing cause, and the cancer then frequently **starts** from a **blood extravasation,** the result of the injury.

Hereditary disposition surely is of much less importance.

The age most affected is the fourth and fifth decennium, especially the years between forty-six and fifty-one. White women are more frequently the victims of carcinoma than those of the colored race in the proportion of two to one. Frequency.

Carcinoma of the breast rarely comes to the observation of the physician in its very first stage, as the beginning of the disease is not accompanied by pain, and at that time only by chance a small lump is detected by the patient in the breast.

Later on **lancinating pains** represent the first symptom; then palpation shows a hard **nodule** with uneven lumpy surface. This nodule is not movable, and its fixedness in the gland is under all conditions a very important sign of the malignity of the growth. First symptoms.

Another **important symptom** is the fact that the **nipple is drawn in,** but this is not pathognomonic, because all processes of the breast producing shrinking of tissue have the same effect. The symptom is of value if present, but its absence does not speak against cancer.

The involvement of the **axillary glands** is a very uncertain sign, as it will exist only after the lapse of an indefinite period, and its detection depends entirely upon the experience of the examiner.

To examine the axillary glands the arm has to be adducted to the thorax, not elevated; the pectoral muscle has to be relaxed. The other side should be examined too. Pain in the arm indicates the presence of swollen glands. The first gland to be enlarged is the one under the lower edge of the pectoral muscle at the level of the third rib. Examination of axillary glands.

The palpation of the breast shows usually a single nodule, most frequently in the upper and outer quadrant.

Diagnosis.

To reiterate briefly: the diagnosis of carcinoma is certain, if we find a **dense, hard, immovable nodule** in the mamma with the skin adherent, if the **nipple** is **drawn in** and the **glands** of the **axilla** are **enlarged**. In later stages **cachexia** is evident, which sometimes appears rather early, and is shown by the pale, yellow, sallow complexion, accompanied by emaciation. As mentioned before, the affection of the glands is the most unreliable symptom, and their detection, especially in fat individuals,

TABLE OF INFLAMMATIONS AND

	Paget's Disease.	Chronic Mastitis.	Interstitial Mastitis (Pebble-stone Mamma).	Tuberculosis.	Actinomycosis.
Etiology	Eczema		Acute Mastitis	Scrofulosis or tuberculosis in other organs.	
Age	40 to 60	About the menopause.	Women who bore, but did not nurse.	After puberty	
One or both breasts	One or both	One or both	Both (frequently)	One	
Pain	Burning pain	No pain	Pain; during menstruation, pain and swelling.	None	
Seat of tumor	Mammilla				
Form of tumor	Raspberry form	Variable; mamma itself.	Nodules or disc-like, smooth.	One abscess or a number of disseminated tubercular nodules, first hard, of knobby surface, later confluescing to one abscess.	
Size of tumor	Raspberry	Variable	Hazelnut		
Number of tumors.	One	One	Several		
Consistence of tumor.	Soft	Changing from hard to soft.	Hard, leathery, callous (nodules cannot be felt with flat hand, only between fingers).		
Formation of cyst.		None	None		
Tumor movable in breast.			Movable	Movable in beginning.	
Mammilla	Mammilla only affected.	May be drawn in.	Unaffected	Usually drawn in	
Axillary glands	None	May be affected.	None	Infected	
Adherence to fascia / Adherence to skin.	None	None	Usually none	None	
Frequency	Rare	Rare	Rare	Rare	Very rare
Development	Two years	A few weeks	Slow	Very chronic	Slow
Microscopical examination.			Proliferation of intralobular connective-tissue septa.	Bacilli tuberculosis.	Grains of sand show actinomyces.
Bacteriological examination.				Bacilli tuberculosis.	
Recurrency		None	None		
Metastases		None	None	Occur	

is extremely difficult even to the experienced examiner. In all cases where the diagnosis of cancer is certain, not only the **entire breast,** with the skin over it, must be **amputated,** but the **axilla** has to be cleaned out thoroughly, whether enlarged glands are apparently present or not.

The later course of cancer is characterized by **ulceration,** with a further involvement of the glands. Later course.

Pressure on the vessels of the arm ensues, with severe disturbances of circulation.

In rare cases cancer of the male mamma has been observed.

TUMORS OF THE BREAST.

Echinococcus.	Mastodynia (Neuralgia).	Hypertrophy.	Fibro-adenoma.	Sarcoma.	Carcinoma.
.....	.....	.....	.....	.....	Trauma.
.....	.....	After puberty	20 to 30, sometimes to 40.	30 to 40.....	After puberty, mostly after 40.
.....	One or both..	Both	One.....	One.....	Usually one.
.....	Intense, like electric shock	None, except during gravidity.	None	None	Pain, very soon severe.
... .	.....	.....	Any quadrant of breast.	Any part of mamma..	Upper outer quadrant (most frequently).
.....	No tumor or hard lumps.	Excessive growth of entire breasts.	Round, encapsulated.	All forms.....	Round or flat lumps, knobby.
Size of egg ...	Size of nut...	.....	Hazelnut to man's head.	All sizes.....	Hazelnut to fist.
.....	.....	.....	Usually one.....	One or more	One.
.....	Hard	....	Hard, later sometimes cystic.	Hard or soft.....	Usually hard.
Cyst	Cyst.....	.....	Cysts are found	Cysts very frequent...	Cysts rare.
.....	Movable	.....	Movable.		
.....	.....	.....	Normal	Usually not drawn in.	Usually drawn in.
.....	.....	None	None	Usually none.....	Glands soon involved.
.....	.....	.....	None ..... None	Cystosarcoma not adherent; others may be so.	Adherent to both.
Very rare.....	Rare	Rare	Fairly frequent.....	Rare	Very frequent.
Slow.....	Slow	Within a few months.	Several years.....	Cystic and spindle-cell, slow; round-cell very fast.	Fast.
Shows (not always) hooks; chemical examination of fluid: no albumin.	Neurofibromata.	Hypertrophy..	Hypertrophy of connective stroma surrounding the glandular.	All forms of sarcoma (small-cell, large-cell, round-cell, spindle-cell, giant-cell, alveolar sarcoma, angio-, lympho-, chondro-, medullary, melanosarcoma).	Atypical growth of epithelial elements.
.....	.....	.....	None	Very frequent, if death does not occur early.	Frequent.
.....	.....	.....	None	Frequent.....	Frequent.

INJURIES AND DISEASES OF THE SPINAL CORD AND ITS MENINGES.

I describe the injuries and diseases of the spinal cord and meninges before those of the spine, to avoid repetitions later on. Most affections of the spine become important by their influence upon the spinal cord.

The surgically important affections of the cord and its adnexa mostly represent **total** or **partial interruption of continuity,** especially such as are confined to one or two segments.

The actual interruption of continuity occurs by tearing, crushing, or shot or stab wounds.

In **contusion** usually the nervous elements of the spinal cord are more affected, while the outer form of the cord and the meninges are more or less preserved.

In **compression** we have to deal with abolition of the efficiency of nervous elements.

For practical purposes it is important to **differentiate** the complete from the partial interruption; of the latter the unilateral lesions are so characteristic and of such frequent occurrence that they deserve special mention.

Total lesion.

Total lesion is usually **traumatic** and sudden; either the cord tears apart, or is crushed. Slow compression very rarely leads to complete destruction, death usually occurring before the compression has become complete. From the moment of the accident the **conduction** from and to the regions, whose nerves are given off below the injured segment, is completely **interrupted.** Therefore we find—

1st, complete anæsthesia.

2d, absolute paraplegia.

All **tendon reflexes** are gone, but no atrophy or degenerative reaction follows.

From **vasomotor paralysis,** intense hyperæmia of the lower extremities ensues, producing anæmia of the internal organs.

This has a serious effect on the kidneys.

The **bladder** and the **rectum** are completely **paralyzed** and anæs-

thetic. Retention of urine in the first week is followed by incontinence. After a short time **cystitis** develops, usually brought about by catheterism.

Retentio alvi is followed after awhile by incontinentia. The abdominal muscles being completely paralyzed, evacuation of the rectum is exceedingly difficult.

Another very important symptom is the **decubitus.** The formation of bed-sores is due to trophic disturbances.

Unilateral lesion.

The unilateral lesion has, in contrast to total lesion, a comparatively **good prognosis,** and usually begins to disappear one or two weeks after the injury. Bladder and rectum are usually not affected, but if they are, the symptoms disappear entirely within ten to fourteen days.

The **muscular sense** is **lost** on the **affected side.**

There is **hyperæsthesia** on the injured side to touch, pain, and temperature.

On the **sound** side there is **hyperalgesia** and **thermohyperæsthesia,** while the muscular sense is intact.

Injuries above the first dorsal segment show, besides the symptoms mentioned, paralysis of the oculopupillary fibres of the sympathetic nerve of the same side.

It is impossible to describe all the different symptoms according to the site in which the pathological condition exists. It must suffice to give the following table (pp. 118–119).

Injuries and diseases of the meninges have in common either hemorrhage or inflammation. The inflammation may either be external **pachymeningitis** or intradural **meningitis.**

Symptoms.

All these conditions are characterized by symptoms due to the affection of the intradural nerves and the roots perforating the dura. **Irritation** of the **sensory nerves** causes pains in the back, which are present even at rest, and increased by motion; therefore the spine is held stiff. Stiffness in the neck in the form of **opisthotonus** or **orthotonus** is always constant. The contracted muscles are tender, sometimes spontaneously, always on pressure.

The affection of the roots produces **symptoms of excitation,** as hyperalgesia, abnormal sensations, and neuralgiform pains. The contractions may be of different degree. In lighter cases motion is only impaired, in the more severe cases it is entirely abolished.

Affection of roots of nerves.

The affection of the roots passing through the meninges is first characterized by a state of excitation; later on paralysis ensues.

Localization of the Functions in the Different Segments of the Spinal Cord.

(TABLE ACCORDING TO BERGMANN.)

SEGMENT.	MUSCLES.	SENSIBILITY OF THE SKIN.	REFLEXES.
2d and 3d cervical.	Sternocleidomastoid, Trapezius, Scaleni and muscles of the nape of the neck, Diaphragm.	Nape of the neck and occiput.	.....
4th cervical.	Levator anguli scapulæ, Rhomboideus, Supra- and infraspinatus, Deltoid, Supinator longus, Biceps.	Shoulder (according to Dana, front of shoulder).	Enlargement of pupil on excitation of the nape of the neck (4th to 7th cervical).
5th cervical.	Supinator brevis, Serratus magnus, Pectoralis major (clavicular portion), Teres minor.	Radial side of arm on volar and dorsal face up to insertion of deltoid; back portion of shoulder?	Scapular reflex (5th cervical to 1st dorsal), tendon reflexes of the respiratory muscles.
6th cervical.	Pronators, Brachialis internus, Triceps, Long extensors of the hand and fingers.	Radial portion of hand (volar and dorsal side) to the mesial line of the middle finger and up to carpus; narrow strip on volar and dorsal side up to shoulder, adjoining the previous region.	Tendon reflexes of the respective muscles.
7th cervical.	Pectoralis major (costal portion), Latissimus dorsi, Teres major, Long flexors of the hand and fingers.	Ulnar portion of hand (dorsal and volar side) from mesial line of 4th to mesial line of 3d fingers; mesial strip on volar and dorsal face of arm, adjoining previous region.	Volar reflex of hand, tendon reflex of respiratory muscles, periosteum reflex of radius and ulna.
8th cervical.	Extensor pollicis longus et brevis, Small muscles of hand.	Ulnar portion of hand (dorsal and volar side) to mesial line of 4th finger; narrow strip of volar and dorsal side of arm up to shoulder.	Tendon reflexes of the respiratory muscles.
1st dorsal.	... ...	Narrow region on the ulnar side of upper and lower arm, extending down to the carpus. (The upper part perhaps belongs to the 2d dorsal segment.)	Tendon reflexes.

(TABLE ACCORDING TO BERGMANN.)—*Continued.*

SEGMENT.	MUSCLES.	SENSIBILITY OF THE SKIN.	REFLEXES.
2d to 12th dorsal.	Muscles of back and abdomen.	Skin of breast, back, abdomen, and upper gluteal region.	Epigastrium reflex, abdominal reflex. (According to Dinkler the epigastrium reflex belongs to the 9th, the middle and lower abdominal reflex to the 10th to 12th dorsal segments.
1st lumbar.	Abdominal muscles, Ileopsoas.	Skin of pubis. Front of scrotum.	Cremaster reflex (1st to 3d lumbar).
2d lumbar.	Sartorius, Flexors of knee? Quadriceps femoris.	Front and inner side of hip, inner face of leg to ankle, inner side of foot, outer side of hip, groin.	Patellar reflex (2d to 4th lumbar).
3d lumbar.	Rotator inward of thigh.		
4th lumbar.	Adductores femoris, Sartorius? Abductores femoris, Tibialis anticus, Muscles of calf, Flexors of knee?	Rear of hip, of thigh, outer portion of lower leg and foot, dorsum of foot, back of thigh, outer side of leg and foot.	Gluteal reflex (4th and 5th lumbar).
5th lumbar.	Rotator outward of hip, Flexor of foot? Extensors of toes, Peronei.		
1st and 2d sacral.	Flexor of foot and toes, Small muscles of foot.	Skin of sacrum, anus, perineum, and genitals.	Plantar reflex, Reflex of tendo Achillis.
3d to 5th sacral.	Muscles of perineum.		Reflexes of bladder and rectum.

NOTE.—The brackets at the left refer only to the muscles, and show in what manner the derivation of the latter sometimes overlaps.

Hemorrhages may be either extra- or intradural. They are frequently **combined** with **injuries** to the **ccrd**. Then the symptoms produced by the latter will overshadow the former. The blood has a tendency to spread downward. The space into which the blood extravasates is large, and can hold quite a quantity, therefore the symptoms of intradural hemorrhage are slight as far as the cord is concerned, while the root symptoms are more pronounced, and even more distant roots may be affected. Hemorrhages.

The symptoms reach their height in a short time, in the first twenty-

four hours at the most, but may then increase from a secondary inflammation. They usually last no more than four to six weeks.

Extra- and intradural hemorrhages may of course be combined.

Inflammations.

Inflammations of the meninges may be extra- or intradural, either occurring as a result of a **wound,** or transmitted by an **inflammatory process** of the vertebræ.

The **external pachymeningitis** is frequently the result of acute **osteomyelitis** of the vertebræ, or still more frequently of **tuberculosis.** This inflammation produces œdema, which increases the symptoms brought about by pressure.

The **intradural meningitis** is characterized by its quick spreading over the entire cord; septic processes are initiated by a chill and show high temperatures. In case of any doubt **lumbar puncture** will decide the diagnosis.

INJURIES AND DISEASES OF THE CORD.

Complete severing of the cord shows the **symptoms** described above under the heading of **total lesion.**

The symptoms of a **partial lesion,** with those produced secondarily by hemorrhage and degeneration, may be **compared** with those of the **total lesion** as follows:

Total lesion.

The total lesion exists, if after a few days the **tendon reflexes** in the paraplegic region are **absent constantly,** if a **motor paralysis** of both sides is approximately **symmetrical,** and if the complete **sensory paralysis** reaches as far as the motor paralysis, and if, besides this, bladder, rectum, and the vessels, show the above-mentioned symptoms of paralysis.

Partial lesion.

A partial lesion is present, if the **tendon reflexes** are **present** or soon return, and if the sensory and motor paralyses are incongruent. **Asymmetry of the paralysis,** or incomplete paraplegia, speaks for partial lesion; also changes in the symptoms or late appearance of the same. The diagnosis of **hæmatomyelia** is important, as in severe cases an evacuation by lumbar puncture may be of great value.

Case.

In one case of mine, which I have published extensively, the alarming symptoms of compression of the cord were materially reduced by aspiration of 75 c.c. of fluid blood twelve hours after the injury.

Compression of Spinal cord.

Compression of the cord and external meningitis are mostly due to **tubercular caries** of the vertebræ. The prognosis in these cases is not absolutely fatal; an **early diagnosis** of the affection, especially in the

cervical region, may lead to an operation of great value. A good Roentgen picture may aid materially.

In one of my cases of laminectomy the symptoms of caries were rather indistinct, only severe pain in the back of the head and neck and slight symptoms of the compression were present. The *x*-ray picture showed a focus in the 4th and 5th vertebræ. I removed the bodies of the 4th and 5th cervical vertebræ, whereupon the tuberculous process stopped, and complete cure followed. Case.

Compression of the Cord by Tumors.

Tumors of the cord and its adnexa are of great interest and importance to the surgeon, as the growth is usually of a **benign** character and therefore offers good chances for operation. They are by far more frequent in the intradural form, and therefore affect the **roots** first, while the symptoms of compression appear relatively late, or not at all.

The diagnosis becomes probable if, after a long time (sometimes two years) of existence of the symptoms of excitation, **slow compression** follows. The diagnosis becomes still more probable if the **root symptoms** are constantly **unilateral**, and the **cord symptoms** show for a time the character of a **unilateral lesion.** Diagnosis.

INJURIES AND DISEASES OF THE SPINE.

Congenital Deformities.

By far the most common congenital deformity is **spina bifida.**

If the formation of the medullary tube is arrested, complete closure does not take place. The typical **seat** for the affection is the lumbar and sacral region. The **principal symptom** is a fluctuating tumor in this locality, of spherical or hemispherical form. The **skin** over it may be normal or absent. According to the **contents** of the tumor, we distinguish myelomeningocele or meningocele. In a number of cases the spina bifida is **hidden by a benign tumor,** like lipoma, fibroma, dermoids, etc., which occur quite frequently in this connection, and may make the diagnosis rather difficult.

Myelomeningocele.

The **prognosis** of spina bifida is **bad,** more so in the myelomeningocele, where it is practically impossible to prevent meningitis; even if the sac is closed, ulcerative processes may cause **perforation,** which may either end fatally at once, or later on. The different forms of paralysis, especially that of the bladder, lead with certainty to death sooner or later.

Meningocele.

In the simple meningocele, which is, in contrast to the other forms, not accompanied by other deformities nor by paralysis, the **prognosis** is slightly better, although perforation with its sequelæ menaces even those cases.

As the prognosis of these cases, if left alone, is so very infaust, radical **operation** for closure of the spina bifida, similar to the radical operation for other hernias, is strongly indicated, except where the defect is too large, or the clinical symptoms of severe paralysis or complete paraplegia speak against it.

INJURIES OF THE SPINE.

The symptoms of an injury of the spine may be threefold:

1st. The general symptoms of a severe injury, as shock,

2d. The local symptoms, and,

3d. The symptoms caused by the lesion of the cord.

The peculiar architectural construction of the spinal column modifies

Architecture of spinal column.

the usual symptoms of a dislocation or fracture in such a way, that the bones to be examined are partly so hidden that it is necessary for us to recall the **anatomical conditions** of the spine to understand the injuries of its parts. The **spine** represents a system of **a triple column,** of which the three constituting pillars are arranged in a triangular form: in front, the massive pillar built by the corpora of the vertebræ and their interlying disks; posteriorly and laterally, the two much more slender pillars formed by the articular processes. The capsulæ and ligaments connect the constituents of these columns, *i.e.*, of this triple column, which is at once exceedingly **stiff and elastic.** The latter quality is due to the interposition of the disks in the anterior part, and to the sequence of a double row of joints in the posterior part.

The usual **separation of dislocations from fractures,** as customary in other bony parts of the body, is **impossible** in the description of injuries to the spine, since, for instance, a complete dislocation of the spine is only possible if a fracture has taken place at the same time. We therefore differentiate partial injuries of the spine from the total fracture dislocations.

Examination of injury to spine.

The examination of a patient with a probable injury to the spine, is not only very **difficult** as to the determination of the exact character and seat of the injury, but calls also for **extreme caution;** one single inadvertent passive motion in handling or examining the patient may prove fatal. Before we look, therefore, for any local symptoms of injury, we ought to ascertain how far the **cord is injured,** for two reasons: first, to prevent any undue violent movement, and secondly, because the establishing of certain **nervous symptoms** points to the **corresponding seat** of the injury. For this reason we note the **respiration** and the possible presence of **priapism** and **meteorism,** examine the skin with needle-pricks for **disorders of sensibility,** examine for paralysis by asking the patient, if he is conscious, to move the different limbs, find out by percussion how far the bladder is filled, examine the **reflexes** and the electro-muscular conduction in paralyzed parts, find the boundaries of normal, anæsthetic, and eventually hyperæsthetic skin, and take the general temperature, as well as the local temperature of paralyzed parts, and finally examine the urine as to its quantity and for sugar and other abnormal ingredients.

The old rule of ascertaining as much as possible during examination by simple **inspection,** before the application of palpation, is in these cases more important than anywhere else.

Forms of injury. To go back to the different forms of injury, we discriminate the following:

I. Partial injuries:

1. Distortions of the vertebral joints.

2. Isolated dislocations of the lateral joints (without affection of the bodies of the vertebræ); these may be either unilateral or bilateral.

3. Contusions (infractions and fissures) of the bodies of the vertebræ.

4. Isolated fractures of the bodies of the vertebræ (compression fractures).

5. Isolated fractures of the arcus and processus spinosus.

II. Total fracture dislocations:

6. Total dislocations (dislocation in the lateral joints, combined with displacement of the intervertebral disk).

7. Dislocations with compression fractures (luxation of one or both lateral joints, combined with compression fracture of the body).

8. Total fracture dislocations (luxation of the lateral joints and dislocation of the fragments of the bodies of the vertebræ).

1. **Distortions** (sprains) and **dislocations** are the result of the same mechanism, which finally forces one or both **articular processes** of the **upper vertebra on top** of the articular processes of the next **lower** vertebra, or if the force still persists, until the articular process of the upper is hooked in front of that of the lower.

Symptoms. If the force is spent before this happens, the result of the injury is a distortion of the body of the vertebra. Therefore we have no deformity; the **only** symptom is **severe pain** at the seat of the lesion. Anything causing movement in the affected joint is exceedingly painful, as passive motions, pressure on the head, pressure on the lateral joints and spinous processes not only of the affected vertebra itself, but also of the neighboring ones.

The patient therefore holds his neck absolutely stiff; the ear is inclined toward the shoulder of the affected side, the face turned from it.

Symptoms of the cord are present only if a hemorrhage into the cord has taken place.

2. **Isolated Dislocation of the Lateral Joints.**—They are either unilateral or bilateral. The **unilateral** dislocation is usually the result of a fall backward on the head, especially if the patient turns a somersault. This happens to people standing in an open cart while driving, who fall off backward when the horses suddenly start, or to riders falling off a horse backward.

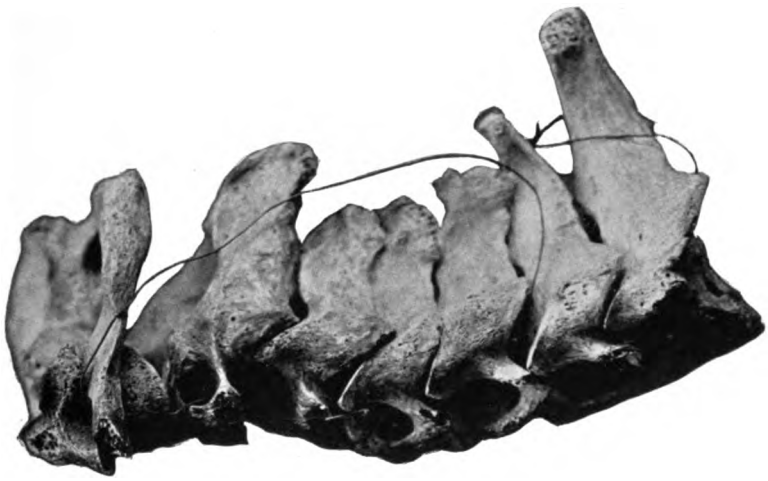


FIG. 1.

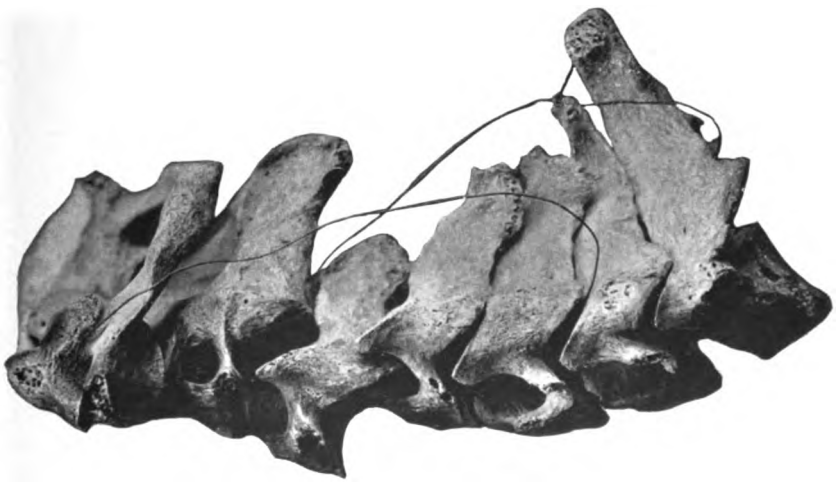


FIG. 2.

DISLOCATION OF SPINE.

FIG. 1. Normal cervical spine.
FIG. 2. Complete dislocation of third cervical vertebra. Articular processes hooked in front of those of the fourth vertebra.

A number of cases have come to observation, where the dislocation was produced by overexertion in active rotation.

Symptoms.

In a **subluxation,** where the articular processes stand one on top of the other, the spine is elongated on the affected side and the **head** therefore **inclined** to the **sound side.** In **true luxation** the head is inclined to the **affected** side.

Dislocations occur mostly in the **cervical** spine. Besides the abnormal position of the head, we find a **deviation of the processus spinosus** of the dislocated vertebra toward the **affected** side. The bodies of the third and fourth vertebræ can be felt from the mouth, where any existing deformity can be detected.

Extreme care has to be taken in this examination, not to be deceived by the **normal prominence** of the second and third vertebræ, which is quite surprising. A like examination of a healthy spine is therefore to be recommended.

X-ray pictures.

The deformity of the three lower vertebræ is detected by the examination of their spinous processes. *X*-ray pictures taken from in front usually give not very clear pictures to the inexperienced eye, but a com parison with normal pictures will greatly aid in the reading of those radiograms.

In **dislocations the pain is less** than in distortions, because the dislocated articular process is resting against that of the lower vertebra. Pressure on the head and the injured region is painful everywhere.

Active and passive motions.

Active motions are avoided, passive are painful as far as they are possible. Rotation toward the affected side is impossible, but the attempt causes little pain. Rotation to the sound side is feasible, and causes acute pain on both sides. Adduction toward the sound side is very painful, adduction to the affected side causes little pain.

Cord symptoms are usually entirely **absent** or only slight, although hæmatomyelia may happen.

Differential diagnosis.

As to the differential diagnosis between dislocation and distortion, it is to be noted that in distortion all motions are possible, but extremely painful. In dislocation a number of motions are impossible, but their attempt causes little pain; besides this, it is characterized by the existing deformity.

Bilateral Dislocation of the Lateral Joints.

In bilateral isolated dislocation, **rotation and abduction are absent,** but flexion is very pronounced. This is still more the case in subluxation than in luxation, where the spinous processes are palpable and diastasis is to be felt, and the processes of the dislocated vertebræ are dislodged forward. The prominence of the dislodged bodies of the two or three upper vertebræ can be felt from the mouth. Radiography may be useful.

The **dislocation** in the **lower cervical region** produces sometimes slight **compression of the œsophagus,** which is indicated by more or less pronounced dysphagia.

Frequently this injury is connected with fractures or dislocations of the bodies of the vertebræ, and then belongs to the total fracture dislocation. Fracture, or in its milder form, infraction (fissure) of the body of the vertebra is produced by compression. The cervical part of the spine is so elastic that it usually evades **compressive fractures.** They are most common in the stiffest part, the **last two dorsal** vertebræ, and the **first lumbar vertebra,** and in rarer cases the third and fourth lumbar vertebræ. Isolated compression of the intervertebral disks is rare and is hardly ever recognized during life.

Symptom.

The principal symptom is a deformity in the form of a circumscribed **kyphosis.** The greater the destruction of one or several vertebræ, the more pronounced the gibbus. In fresh cases, the deformity may disappear after cessation of the pressure, and is only recognizable if the patient is placed in a standing or sitting posture.

If the compression of the two halves of the body of the vertebra is uneven, a scoliosis besides the kyphosis will result.

The **principal symptom is local pain** at the time of the injury. Its degree may be in some cases so slight that the fracture is overlooked until the patient later on tries the erect position.

In cases of **fractures of the sternum,** especially at the junction of the manubrium and the body, one should always look for **fracture of the spine,** as these two injuries very frequently occur simultaneously.

Nerve and cord symptoms.

Nerve and cord symptoms may be varying; the former are produced by direct compression of the nerves of the intervertebral foramina and are recognized by the presence of **lancinating pains.** The cord symptoms correspond with the extent of the injury of the bodies of the vertebræ. If the fracture results in the formation of an **anterior wedge,** the

body will be dislodged forward, and the cord is injured only as far as a compression is possible by this deformity. If a **posterior wedge** is formed, that fragment itself will **press on the cord** with usually much more disastrous results.

In the course of the treatment, symptoms of **renewed compression** may be observed, either if the treatment is not carried on long enough until consolidation has taken place, or if during consolidation the growing **callus** begins to exert pressure on the cord.

Traumatic spondylitis.

Besides this, another condition may be the result of a fracture of the body of the vertebra, called traumatic spondylitis. The crushed vertebra then represents a *locus minoris resistentiæ*, where, after the lapse of a certain time—even as late as a year and a half—**osteomyelitic** degeneration of the bone sets in. This free interval is characteristic.

It is necessary to know this clinical picture, on account of the question whether a disease developing a long time after the injury is in any causal connection with the latter. This question is the more important as those patients are to be considered disabled for life.

Another consequence of compression fracture of a vertebra may be the development of **tuberculous spondylitis** in patients with a tendency to this disease. In those cases it may be said that the spondylitis would not have developed but for the accident.

Permanent results of the injury.

The judging of the results of this injury presents unusual interest, as the more serious symptoms of contusion of the spinal cord are usually absent. The chances for appropriate **surgical treatment,** either by orthopedic methods or by laminectomy, are comparatively good, and we have finally to deal with a fracture healed with more or less deformity. It is a well-known fact that patients with a very pronounced **gibbus as the result of fracture** are able to perform quite heavy work, while others, who have no interest in exaggerating their complaints, as is so frequently not the case when litigation results from the injury, confess to great constant pain and inconvenience. Only extremely careful examination will prevent great errors in judging these results from injuries. In a great many cases the patients become hypochondriac and neurasthenic.

Railway spine, or traumatic neurosis.

It may be well to mention in this connection railway spine. Formerly it was assumed that in a great many accidents, especially railway accidents, **concussion of the cord** took place, corresponding with the concussion of the brain, an assumption which has been definitely proved to be **illusory**. (Recently the same condition has been named **traumatic neurosis.**) This implied that while coarser material injuries of the ner-

vous system were absent, finer changes had occurred, which had not been made out anatomically. But nothing of the kind exists; the trauma is not on the nervous tissue but on the psyche, and all the symptoms existing have to be explained from this point of view.

Isolated Fractures of the Vertebral Arches and Dorsal Processes.

The fractures of the arches are **rare**. They occur most frequently in the cervical region, the atlas and axis being also subject. They may result in serious **lesion to the cord**, which causes death in a short time. If these symptoms are absent, the fractures heal well.

The **diagnosis** rests on the symptoms of swelling, extravasation of blood, local pain, abnormal mobility and crepitation, eventually combined with cord symptoms.

While those cases without cord symptoms yield readily to fixation, those **with cord symptoms** need operative procedure and removal of the frequently dislodged fragments pressing upon the cord.

Isolated Fractures of the Spinous Processes.

Isolated fractures of the spinous processes are **rare** and occur most frequently in the dorsal part; generally more than one process is fractured. The symptoms are the same as above, but cord symptoms are entirely lacking.

The prognosis is good, and operation is hardly ever necessary.

Total Fracture Dislocations.

In these cases the entire column of the spine, consisting of three pillars, as described above, is displaced, the upper part from the lower. Either it is a total dislocation, the body of the vertebra being torn from and slipping over the lower disk and the articular processes above being dislocated, or we have a dislocation or fracture of the articular processes and a fracture of the body, with a more or less inclined line of fracture.

According to these different forms the **displacement** is in some cases extreme.

The injury usually causes **complete contusion of the cord,** and all cases are **fatal** sooner or later; only the crushing of the cauda equina need not be fatal.

The **total fracture dislocations of the two upper cervical vertebræ,**

or the dislocation of the head, have special characteristics according to the anatomical conditions. While the rule holds good that the fractures of the spine are the more serious the higher up they occur, this "breaking of the neck" (frequently the result of diving) is not necessarily fatal at once. The vertebral canal is so wide at that level that quite pronounced displacement is possible before cord symptoms ensue. Dislocation of the head.

Symptoms of the total fracture dislocations are pronounced displacement, recognized by the gibbus, the point of which is formed by

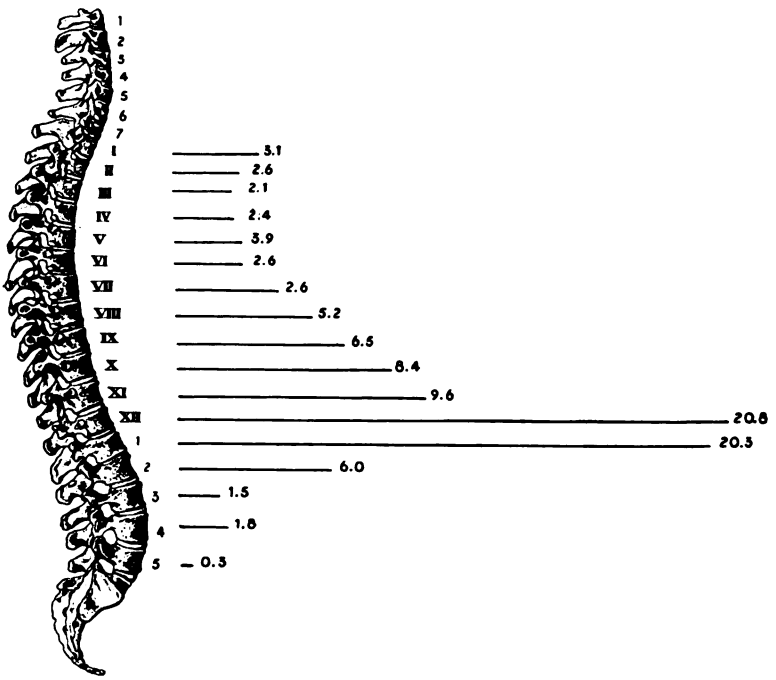


FIG. 6.—Percentage in Frequency of Fractures of Dorsal and Lumbar Vertebræ (Compiled from 383 cases by Ménard).

the spinous process of the lower vertebra, while that of the upper lies lower than normal, and shows diastasis.

Besides swelling and bloody suffusion, local pain is present, which increases on pressure. **Greatest care** has to be exercised in making out these symptoms, as undue pressure might force a fragment into the cord. Examination for sensitiveness by pressure on the head or shoulders ought to be **avoided rigidly**; under no condition is it permissible to have the patient sit up. For examination of the back, the patient is Examination.

rolled with sufficient assistance exceedingly carefully on his side. Examination for **abnormal mobility** and crepitation must be **omitted** entirely.

The most serious effect is the **lesion of the cord,** which differs with the height of the segment.

For the first, it is usually sufficient to establish the fact of injury to the spine, the finer examination, especially of the nervous lesion, is to be left until the patient is in bed and extension is being made.

DISEASES OF THE SPINE.

Acute Osteomyelitis of the Spine.

It is comparatively **rare.** It usually attacks young people before the twentieth year. It occurs most frequently in the lumbar region, and any part of the vertebra may be diseased.

Symptoms. The symptoms are those of any other osteomyelitis, high fever, frequently initiated by chill, frequent pulse, severe headache, delirium and somnolence. If the patients are conscious, they complain of **severe local pain,** spontaneous as well as on pressure. The spine is held stiff. Later on œdematous swelling occurs. If the **posterior** parts of the vertebræ are affected, a forming **abscess** will have a tendency to break through toward the back, which may happen from the third to the seventh week. If the **anterior** parts are affected, the abscess hardly ever reaches the back, and the patients usually succumb to the **general infection** before the formation of a psoas abscess (as in tuberculosis) is possible.

The **cord symptoms** are either those of **compression,** exerted by the accumulation of pus and œdema, or **spinal meningitis.** If the cervical region is affected, basilar meningitis nearly always results. Sacral osteomyelitis usually produces sciatica.

Diagnosis. The diagnosis is sometimes difficult, especially if the acute symptoms of the infectious disease, or later on septic pleuritis, pneumonia, peritonitis, and meningitis, overshadow the original disease. After typhoid, acute osteomyelitis has been observed.

Pott's disease. **Tubercular spondylitis,** Pott's disease, is by far the most frequent inflammatory disease of the spine.

Like other tuberculous affections of the body, spondylitis is not inherited directly, but only the **tendency** toward tuberculous diseases.

The usual tendency to regard trauma as responsible for spondylitis is surely wrong, as probably most, if not all, children have had falls which might affect the spine. On the other hand, **hemorrhage** as the result of a trauma may form a spot, where tuberculous virus, in those patients with a tendency to it, is deposited and may develop.

Tuberculosis of the spine **starts,** practically in all cases, in the **body** of one or more vertebræ. The **intervertebral joints** are affected only after the morbid process in the body has perforated into the joint. As the result of a tuberculous affection the bone is destroyed and sinks in. If only one vertebra is diseased, the form of the gibbus is a sharply defined angle, the gibbus is pointed; while if several vertebræ are affected, the resulting deformity is a rounded bend. Form of gibbus.

The deviation is forward and forms a **kyphosis.** The gibbus or hump is **most pronounced** in the **dorsal region;** in the lumbar region, where there is normally a lordosis, the spine has first to be straightened before a kyphosis becomes apparent. In some cases the gibbus may be absent entirely.

The deformity of the spine is naturally followed by considerable **deviation** and transformation of the **thorax.**

In **lumbar** kyphosis the **pelvis** is also affected, the frontal diameter becoming shortened and the sagittal diameter elongated. Even the **head** is transformed, the mento-sagittal diameter becoming elongated.

The **contents of the thorax,** the lungs and the heart, and especially the large vessels, will follow the changes of the thorax. The usual result is stenosis of the aorta (with hypertrophy of the left heart) and general stasis.

This has been held responsible for the comparatively **rare tuberculous affection of the lungs** in spondylitis patients.

The **nervous** symptoms are the result of **compression** of the cord and roots and possibly the plexus; the latter is usually affected by the cold abscess, which I shall mention presently. Symptoms.

Even at the beginning of the disease, **neuralgiform pains** in the extremities and thorax, and girdle sensation, are present. The **cord symptoms** begin with a feeling of weakness, combined with spastic conditions. Later on paresis and paralysis may develop slowly, or with sudden exacerbations. The **root symptoms** are usually only transient, bladder and rectum are generally not seriously affected, and show at the most paresis for a while.

The result of the disintegration of the bone is the formation of an

Formation of abscesses.

abscess, which will follow different paths according to its seat. The **perforation** practically always **takes place forward.** The pus is infectious, and may on its way downward infect other tissue with which it comes into contact.

The abscess from the **upper cervical** vertebræ will show as a retropharyngeal or retro-œsophageal abscess. Later on it may perforate into the mediastinum. The bodies of the **atlas** and **axis** are so small that a perforation into the surrounding joints must take place very soon. This results in the so-called **tuberculous spondylarthritis** or malum vertebrale suboccipitale, which was known even to Hippocrates. The first symptoms are usually nervous; severe neuralgia in the region of the occipital and auricular nerves. Functional **disturbances of the hypoglossus** produce difficulty in the motions of the tongue and swallowing; besides this, lid-clonus, nystagmus, and difference of pupils exist. The **first sure sign** is a characteristic stiff carriage of the head, which is followed by a slow sinking of the head forward. At the same time **motor paresis** of the arms appears, the strength of the hand decreases; the paresis is spastic. Later on the **lower extremities** take part, finally bladder and rectum, thorax and diaphragm; the paralysis is symmetrical.

Symptoms of abscess from cervical vertebræ.

The **prognosis,** corresponding to the rule: the higher up a lesion of the cord is, the poorer the prognosis, is extremely infaust.

Abscesses from dorsal and lumbar vertebræ.

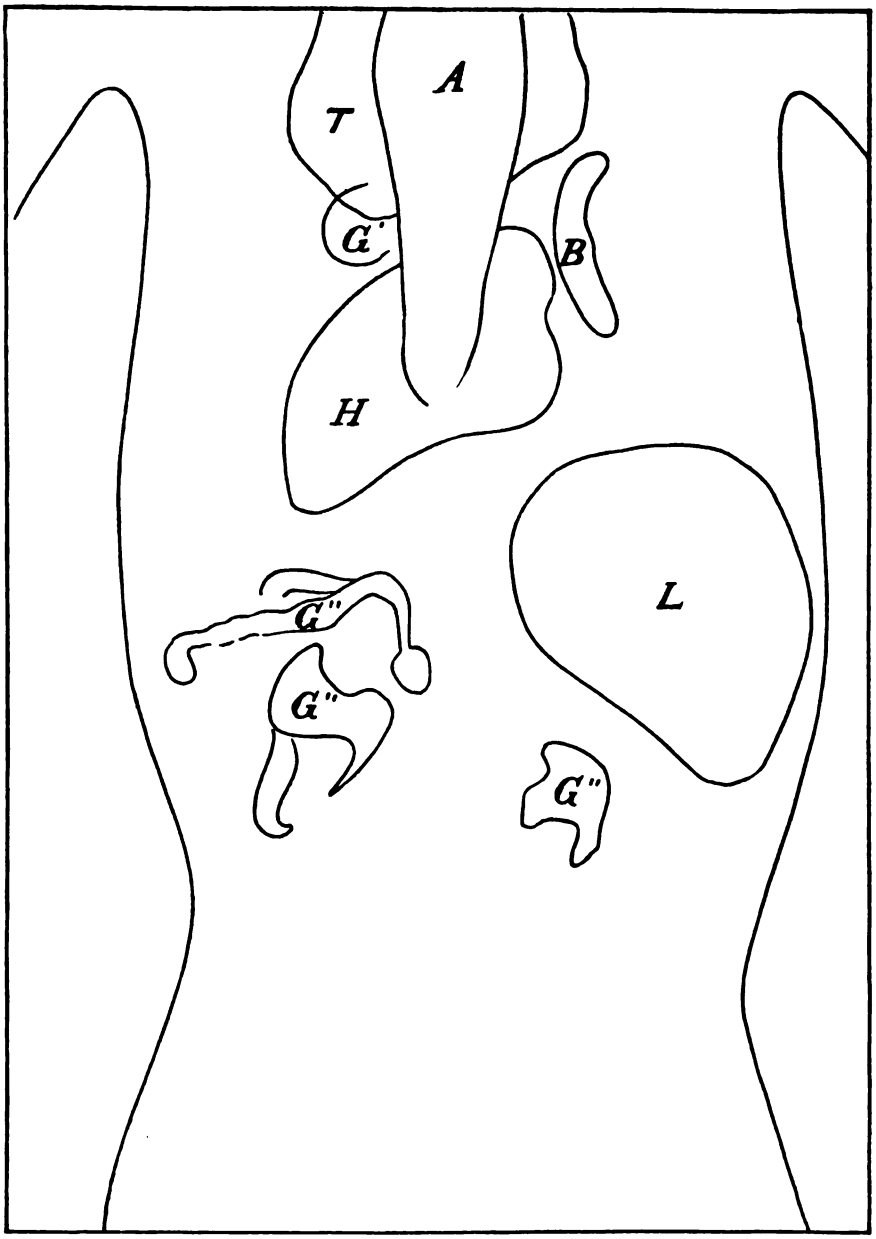
An abscess of the dorsal vertebræ usually follows the aorta and finally appears under Poupart's ligament as an **iliofemoral abscess** or, if the abscess follow the internal iliac, as an **ischiofemoral abscess.**

Abscess of the lumbar vertebræ appears as a **psoas abscess** on the anterior mesial surface of the thigh. Sometimes the synovial bursa of the psoas is infected, thus endangering the hip joint. A **rare** form of abscess is the **iliac abscess,** due to the affection of the last lumbar vertebra.

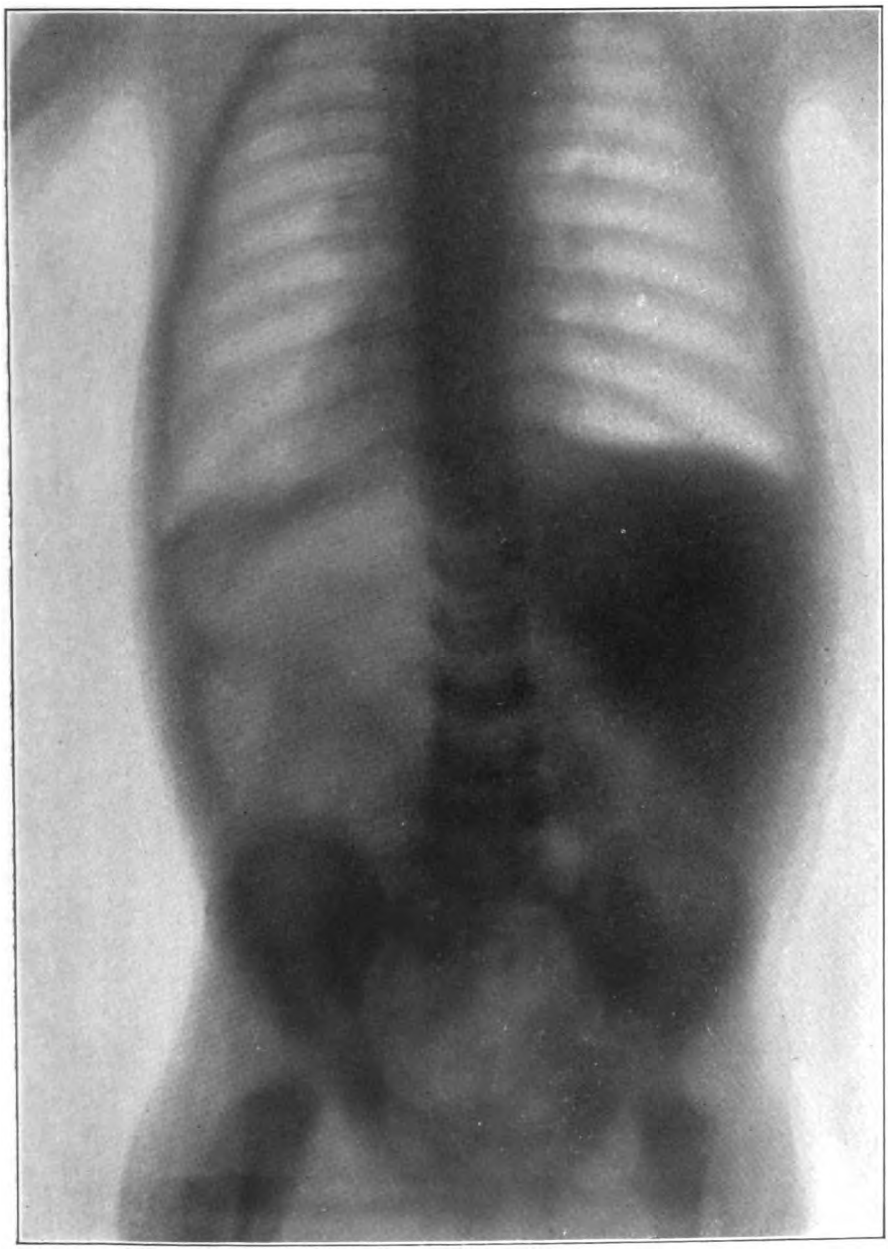
Not too rarely the abscesses are **bilateral,** according to their origin in the mesial line.

The **result** of an abscess in the vertebral canal is rarely compression of the cord, frequently **tuberculous pachymeningitis.**

The **clinical** symptoms are, as mentioned above, **local pain,** spontaneous as well as on pressure. This induces a special characteristic carriage of the body. The patients hold either a part of the spine or the entire spine stiff. They can bend down only to a certain degree, beyond which most excruciating pains ensue. In cervical spondylitis



A. Retro-œsophageal abscess.
T. Persistent thymus.
B. Bronchus.
G'. Caseous bronchial gland.
H. Heart.
L. Liver.
G''. Retroperitoneal glands.



RETRO-ŒSOPHAGEAL ABSCESS, TUBERCULOUS.

Only case of successful skiagram of such an abscess.

For further explanation, see cover.

the patients carry the head with one or both hands; in lower spondylitis they prop up the spine by resting the hands on the thighs in walking, or on the chair in sitting and getting up. It is of some importance to know that some patients complain of belly-ache, increased after eating, which is **characteristic for spondylitis**, as the pain in the knee for hip disease. After the formation of a gibbus, the patients endeavor to bring about the static equilibrium by compensatory curvatures. Characteristic positions.

The **prognosis** of tuberculous spondylitis is decidedly infaust, and becomes more so, the older the patients are.

The differential diagnosis may be difficult only in the beginning of the disease, when local pains are the most striking symptom. So-called "growing pains" and those of beginning scoliosis (lateral curvature of the spine) may give a similar impression, but in both cases the spine is not stiff. Differential diagnosis.

The **rhachitic** painful kyphosis disappears if the little patients are laid on the stomach and legs lifted.

The acute osteomyelitis of the spine is characterized by its violent course.

Other diseases of the bones of the spine are syphilis, actinomycosis and (usually malignant) tumors of the spine, as carcinoma, etc. They show, if they come to the surface, the characteristic symptom of the respective disease, and may besides show the symptoms produced by compression of the cord. Tumors.

CURVATURES OF THE SPINE.

Curvatures of the spine are either deviations in a sagittal direction, as kyphosis and lordosis, or in a frontal direction, lateral curvatures (scoliosis).

The **habitual kyphosis,** the round back, develops in youthful individuals at any age from seven to sixteen, in boys as frequently as in girls. Heredity seems to be responsible in some cases. Besides this, a certain laziness, combined with poor muscular development, is responsible.

The diagnosis is self-evident. The **differential diagnosis** from kyphosis due to tuberculosis is easy, by the absence of all signs of inflammation, as pain, etc.; besides this, the deformity, if not of too long duration, can be easily straightened out even actively by the patients.

The same condition may occur in late years, as the result of senile muscular atrophy (Fig. 7, *a*).

Lordosis, an exaggeration of the normal lumbar lordosis, is usually secondary, as compensation of flexion in the hip due to hip disease or congenital dislocation of the hip. Besides this, the muscular appa-

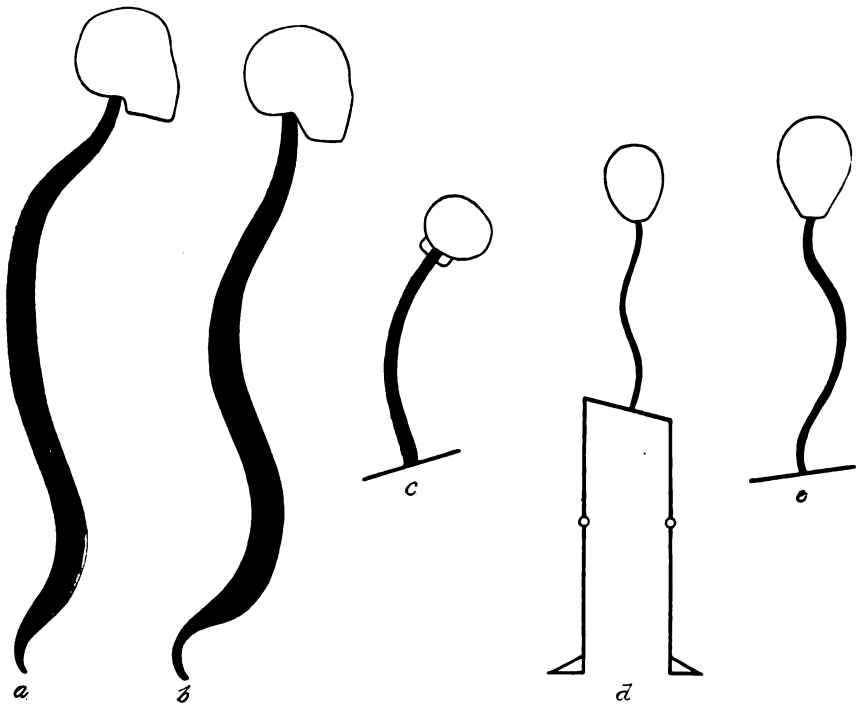


FIG. 7.—Varieties of Curvature of the Spine. *a*, Kyphosis or round back; *b*, lordosis; *c*, rhachitic scoliosis, seen from behind; *d*, static scoliosis; pelvis lowered on account of actual shortening of the leg; *e*, habitual scoliosis; pelvis lowered voluntarily as partial compensation.

ratus may be responsible for it, as in anterior poliomyelitis, or progressive muscular atrophy.

A **rare** etiological factor is spondylolisthesis, the total dislocation of the last lumbar vertebra on the sacrum (Fig. 7, *b*).

Lateral Curvatures.

1. Rhachitic scoliosis.
2. Static scoliosis.
3. Habitual scoliosis.

The **rhachitic** scoliosis shows itself in children with other signs of rickets, at the age when the mother begins to carry them around, seated on her arm. The children are usually carried on the left arm, to leave

the right one free for other occupations; as a result the spine curves in one total scoliosis to the left, in the form of the letter C. The result is a left convex scoliosis (Fig. 7, *c*).

An exact inspection of the nude, seated child from behind will show the deformity plainly.

Static scoliosis is a secondary disease; usually the result of a lowering of the pelvis due to shortening of the lower extremity. This shortening may be brought about either by flexion in the hip or knee, or both, as in the later stages of hip-joint disease, or by an actual shortening of the limb, as in essential infantile paralysis, etc. (Fig. 7, *d*).

In other cases static scoliosis is the after-result of empyema, with or without resection of the ribs.

Habitual Scoliosis (Lateral Curvature of the Spine).

Habitual scoliosis is by far the most frequent lateral deformity of the spine, as well as the **most frequent deformity** of all deformities.

It is the result of a habitual wrong posture of the spine, as it is produced on the school bench by writing and reading in faulty position. It is entirely a **school disease.** Subject to it are children with hereditary tendency, and those with poor muscular development.

Nature of the curvature.

The result upon the spine of this faulty position is a lateral curve, usually right convex dorsal, left convex lumbar, an S-like form, to which is generally added a left convex curve in the cervical region, as compensation. Besides this lateral transformation of the spine and the single vertebræ, a **torsion** along the vertical axis takes place, so that the spine appears wound like a garland around a straight line passing through the first cervical and first sacral vertebræ.

Examination.

To detect scoliosis in beginning cases, the girl (girls are much more frequently affected than boys) ought to be entirely undressed, and to stand perfectly straight with her back to the observer and to the light. Usually the children at first make an effort to stand straight; after a few minutes they assume the faulty position which is natural to them. In beginning cases it is not always easy to detect the curvature in the spine itself; but, first, the **shoulders** are usually not in a horizontal plane; secondly, the **lower angles** of the shoulder-blades are not in a horizontal line; thirdly, one shoulder-blade stands **farther off** from the ribs than the other, so that its lower angle throws a heavier shadow; fourthly, the best means to detect a beginning scoliosis (except by appli-

cation of one of the complicated measuring-apparatuses) is the **comparison of the two triangles** which are formed by the hanging arm as one side, the thorax line from arm-pit to waist as the second, and the pelvis line from the waist along the pelvis to the hand as third. Close comparison of the two triangles will detect the minutest change in the spine. Usually the dressmaker first tells the mother that she finds one hip higher than the other.

Course. As long as the scoliosis is **mobile,** the deformity **disappears** entirely **during suspension.** If cases are recognized during this first stage and subjected to rational treatment, they are nearly all curable. Later on the **deformity increases,** affecting the ribs as well as the pelvis, and a state of contraction results. If it develops still further, the **fixed scoliosis** ensues, with a high degree of deformity of the entire body.

Inspection and palpation of the spine itself show the **deviation** of the spinous processes from the **perpendicular line,** and a lumbar intumescence as a result of the torsion of the spine.

The most prominent indirect symptom is the formation of the **rib-hump.** As only beginning cases are curable, an **early diagnosis** is important, as this makes possible proper treatment, including, whenever feasible, removal from the noxious influence of school.

INJURIES AND DISEASES OF THE PELVIS.

INJURIES OF THE PELVIS.

They are the result of heavy blows or kicks, falls from a great height, or of severe crushing violence, for instance, in quarries or mines; or the patients are squeezed by being caught in elevator-shafts, or between couplers in railroad service, or by being run over by heavy trucks or cars. **According to the intensity** of the force and its duration, the result is either contusion of the soft parts, fracture of the pelvis, or fracture of the pelvis with lesion of the viscera contained therein.

The simple **contusion** is easy to find and localize from its symptoms, as pain, suggillation of blood, abrasions, swelling, hæmatoma, etc., while any more serious symptoms which would indicate a fracture are absent.

Mechanism of fractures of pelvis.

To understand the mechanism of the fractures of the pelvis, it is necessary to recall that the three bones constituting the pelvis form the so-called **pelvic ring.** If we place a bony ring in a vise and screw the latter tight until the ring breaks, it will always **break in two places,** so that a segment of the ring falls out. The conditions in the pelvis, if compressed, are similar.

Force applied in different directions.

The **form of the fracture** largely depends on the direction in which the force is applied. If a man lies flat on his back and the wheel of a heavy truck passes transversely (the patient lying at right angles to the direction of the truck) over the pelvis, the **pubic region** will be fractured. The horizontal and the ascending ramus will break more or less **symmetrically,** anywhere from near the symphysis, or as far as the acetabulum.

If, after this fracture has taken place, the force is not spent, or if a compression takes place from the two sides, as between the buffers of railroad-cars, the **sacral bone** will break too. These fractures just described are the result of force in sagittal direction. If the patient lies on his side, and the force is applied in the direction of the frontal diameter of the pelvis, there will be two fractures of the pelvis: first, a fracture of the two **branches of the pubic bone** on one side; and, sec-

ondly, a fracture of the **posterior part of the ilium** of the same side. Instead of the ilium, the sacrum may be fractured.

If the force is applied to the pelvis diagonally, the side of the pelvis which is subject to the insult usually does not break, but the **double ring fracture** takes place in the **opposite half.**

Besides these forms of fracture of the pelvis, a simple breaking off of the upper part of the ilium can occur. **Another form** is possible, which is produced by the head of the femur being driven through the acetabulum, which will then break in the form of an upright Y, following the **lines of ossification.**

A great many variations of these different forms of fracture, as described just now, are possible, but the minute description is of no practical value, as the finer details of a fracture usually cannot be established during life, and also because it does not make any difference in the treatment. In examining patients with a probable fracture of the

Symptoms.

pelvis we frequently find, first, the **clinical picture of shock**, even if no internal organs have been injured; the patients are pale, do not react, have a small pulse, and cold extremities. As long as the patients are not fully conscious, a peculiar jerking, alternate flexion and extension in the hip-joint is **characteristic.** These motions are contractions due to the direct irritation of the iliopsoas muscle. These involuntary motions stop as soon as the patients are fully conscious; then they complain of **severe pains,** usually localized to a circumscribed spot, but **which radiate,** in case the anterior part of the pelvis is broken, along the thigh to the knee (along the obturator nerve); in case of fracture of the sacrum, the pains are confined to the back, or buttocks, or anus. The patients avoid anxiously any voluntary motion. If, as usually is the case, they have fallen during the injury, they are unable to rise and walk. Besides these functional results we see **abnormal position.** The entire extremity, including the foot, is rotated outward, and sometimes shortened an inch or more. Paralysis of the limbs is rare. The soft parts over the fracture are swollen and saturated with blood. **Ecchymoses** are observed, especially in the region of the ischial tuberosity, and in the scrotum and perineum.

Differential point.

If the evidence of subcutaneous hemorrhage appears above Poupart's ligament, fracture of the pelvis is with certainty differentiated from a fracture of the neck of the femur, where the suggillation appears below the ligament.

After we have observed all these symptoms with our eyes, we pro-

ceed with **palpation.** First, we compress the pelvis in its **frontal diameter** in a very gentle way, then, by placing one hand on the sacrum and one on the pubic region, we press in a **sagittal direction,** and the presence of a fracture will be indicated by a decided increase of pain. If the experiment is repeated, the patient always locates it at the same place. It is not advisable to try to produce crepitation, as the examination may displace fragments, and thus inflict injuries upon the internal organs which did not exist before. Abnormal mobility will make itself evident in a number of cases.

This external palpation should be followed by **examination per rectum,** and in women per vaginam.

Internal injuries.

All the symptoms described so far are due to the injury of the pelvis itself. Of the internal injuries the most important are those of the **urethra** and the **bladder.** Percussion of the bladder will reveal **retention of the urine** due to paralysis of the bladder. In such cases the bladder is distended *ad maximum* until ischuria parodoxa follows if the catheter is not introduced. The latter then frequently evacuates bloody urine, which may sometimes be passed spontaneously. If **clear blood appears** from the urethra, the latter itself is injured. If this is the case, and the catheter is not introduced at once for various reasons, urine infiltration takes place. If the **scrotum is infiltrated,** it indicates a tear in the pars bulbosa; if we find infiltration above the symphysis and above the inguinal regions, and at the same time a dulness in the lower abdominal region, we have to expect a **tear of the bladder.** If the tear is **intraperitoneal,** the peritoneal symptoms, collapse, tenderness of the abdomen, and quickly increasing dulness become apparent. If the introduced catheter evacuates large quantities of bloody fluid, the instrument will have entered the **abdominal cavity** through the tear in the bladder and peritoneum.

Besides this, another method of examination is by **X-ray** photogram. Care should be exercised to place the tube exactly in the mesial line.

Dislocations of pelvic bones.

Dislocations of the different bones constituting the pelvis are extremely **rare** and occur, of course, only where the joints exist. The symptoms will be partly the same, only the faulty motion will be more limited and crepitation will be absent.

DISEASES OF THE PELVIS.

The inflammatory affections of the pelvis are:

1. Acute osteomyelitis.
2. Tuberculosis.
3. Syphilis.

Syphilis. The latter is so **rare** that it must suffice to mention it. If it does occur, it does not show any special characteristics aside from those of any ordinary luetic ostitis and the formation of gummata.

To **differentiate** osteomyelitis and tuberculosis, it is safe to say that those processes which start in the **bone** itself are osteomyelitic, while those which start from the **joints** and, in their later course, attack the bone, are of tuberculous nature.

Osteomyelitis. Osteomyelitis attacks much more frequently the **ilium** than the sacrum. The epiphyseal line of the acetabulum is attacked sometimes; if so, perforation into the hip-joint soon takes place.

The disease as such corresponds with any other osteomyelitis. The beginning is sudden, with high fever and intense pain. The **general symptoms** may be so severe as to cover the local symptoms, for a while at least. After two to three weeks the **local swelling** is noticeable, and will thus **establish the diagnosis,** so that the suspicion that we have to deal with any other infectious disease, as typhoid or acute rheumatism, can be dismissed. If the course is more **chronic,** a number of **fistulæ** will form; then the disease will give rise to an enormous thickening of the iliosacral as well as the acetabular region, and a great number of **osteophytes** are formed. The involvement of the hip-joint might lead to the diagnosis of tubercular hip-joint disease, but the thickening of the bone and the destroyed iliosacral joint will prevent such an error.

Where the onset of the disease is very violent and the affection of the bone extended, only an early **radical operation** gives the patient any chance, while the milder cases with small circumscribed focus need only symptomatic surgical interference. The same is the case with the chronic forms.

Tuberculous affections. Of the tuberculous affections of the pelvis by far the most important is the tuberculous inflammation of the **iliosacral** joint.

The patients, usually men, are twenty to thirty-five years old. The beginning of the disease is insidious. The **first and only symptom** for a long while is **pain** in that region. Frequently the patients do not name

the iliosacral joint as the tender spot, but the region of the anterior superior spine or the inguinal region, or they complain of pains in the anterior or posterior surface of the thigh; practically the pains correspond with those of ischias. Finally a **swelling over the joint** appears, either outside, or to be felt per rectum. Still later an **abscess** is formed, which perforates, and shows the characteristic symptoms of tuberculous fistulæ and discharge.

Differentiation.

The tuberculous inflammation of the iliosacral joint may be mistaken for sciatica or hip-joint disease. The hip-joint is better dealt with under the heading of diseases of the thigh.

PELVIC ABSCESSES.

Psoas abscess has been mentioned under the heading of diseases of the spine.

Iliac abscess.

The iliac abscesses are those which follow the iliac muscle and its sheath, being the result of a suppuration of the iliosacral joint or of the inner surface of the ilium or the acetabulum. The **abscess** finally **appears below Poupart's ligament,** in the space between the outer edge of the iliac muscle and the inner edge of the rectus femoris. If it wanders still farther it may get to the outer edge of the sartorius, so that we can finally say that fistulæ on or outside of the sartorius are **iliac fistulæ,** those inside are **psoas fistulæ.**

Subserous pelvic abscess.

The subserous pelvic abscesses are most frequently due to inflammations of the internal **female organs,** and belong, therefore, to the field of gynecology. **Another form** of pelvic abscess which, though **rare,** ought to be mentioned, is the result of the breaking-down of **retroperitoneal tuberculous glands.**

Finally, pus may collect in the pelvis from any form of abdominal suppuration and suppurative peritonitis, as quite frequently, for instance, in appendicitis, etc.

NEOPLASMS OF THE PELVIS.

They may belong to 1. The soft, outer parts of the pelvis. 2. The bony structure itself. 3. The cellular tissue of the inner surface of the pelvis.

The congenital tumors of the sacral bone we have described in the chapter on the spine.

1. The **tumors of the soft parts** are usually situated in the gluteal region. They are either **benign,** as hygroma, atheromatous cysts, or dermoids, or they belong to the **malignant** tumors, of which sarcoma is the most frequent.

2. The **tumors of the bony structure** are, if benign, exostoses and enchondromas, or, if malignant, usually sarcoma.

For **differential diagnosis** it may suffice to say that the cystic tumors are usually situated in the gluteal region. **Probatory aspiration** will differentiate an abscess or a possible aneurism from cysts, and those again will be differentiated from each other by their contents.

Enchondroma, sarcoma, echinococcus.

The exostoses and enchondromas are recognized by their hard structure and knobby surface, and they are of **slow, painless development** (exclude a possible callus or rhachitic deformity). If they are external, they are usually situated at the anterior part of the pelvis; if they are internal, they are to be found in the iliosacral region. The **sarcomas** are identified by their **painfulness** even at a time when the tumor as such can hardly be recognized, later on by their spreading into the surrounding tissue. General symptoms, as early cachexia, etc., indicate, of course, malignant tumor.

For completeness' sake we may mention the **echinococcus** of the pelvis which will give the **clinical picture** of a cystic tumor, and may lead to the mistaken diagnosis of pelvic abscess or hip-joint disease; the true character can be established only by **microscopical examination.**

INJURIES AND DISEASES OF THE ŒSOPHAGUS.

INJURIES OF THE ŒSOPHAGUS.

Injuries of the Œsophagus from Outside.

Wounds by cut, thrust, or shot, are **rare,** as the organ is situated comparatively deeply.

The cuts across the œsophagus are usually due to tentamen suicidii. Usually the knife or razor enters between the larynx and hyoid bone, or through the larynx itself; in rare cases through the trachea, still rarer above the hyoid bone. As mentioned under injuries of the neck, severing of the large vessels and nerves is rare in those injuries. Transverse cuts.

The injury is **self-evident.** The immediate result is the danger of **suffocation** either by blood and saliva entering the trachea, or by the tongue sinking backward. Later **glottic œdema** and wedged particles of food may produce suffocation.

The principal symptoms are **pain** in deglutition and the **flow of swallowed masses** through the wound. The latter may enter the **respiratory tract** and thus create violent coughing and gagging. In unilateral **injury of the recurrens** the voice is hoarse, in bilateral complete **aphonia** ensues, and narrowing of the glottis by inspiratory traction of the arytenoid cartilages. Therefore the patients with wounds **below the glottis** cannot breathe, as soon as the wound is closed. The result of these injuries is, in a number of cases, formation of fistulæ of the trachea and œsophagus. Symptoms.

Stab and shot wounds are usually more dangerous, as they more frequently implicate vessels and nerves.

Injury of the thoracic part of the œsophagus, at least isolated, is **very rare.** The result is the **infection** of the surrounding tissue by the flow of saliva and food. Thus the pleura and mediastinum may be affected. If the **lung** is injured besides, we observe violent coughing, with bloody sputum, great anxiety, labored respiration, weak pulse; sometimes air or foamy blood escapes through the wound in breathing or coughing, and emphysema may develop. The patient can lie only on Injury of the thoracic portion.

the wounded side and complains of violent pain, which is increased if swallowed substances touch the wound. Burning thirst and singultus are **characteristic.**

Rupture and Perforation of the Œsophagus.

Rupture of the normal œsophagus is extremely **rare.** Immediate collapse and the formation of emphysema spreading from the supraclavicular region are characteristic.

Perforation of the œsophagus, if not made accidentally by foreign bodies or instruments, occurs frequently during the course of **ulcerative processes** following inflammation or from carcinoma. Perforation of the œsophagus usually does not take place suddenly; if so, the symptoms are similar to those of rupture. If the perforation takes place slowly, the symptoms are less violent.

Foreign Bodies in the Œsophagus.

Before we enter upon the description of foreign bodies it is necessary to speak of the **examination of the œsophagus.**

The **entrance** to the œsophagus can be inspected from the mouth, and careful examination of the same will reveal the presence of foreign bodies in that part. **Palpation of the lower part** of the œsophagus is possible, especially on the left side, and foreign bodies can be felt there, though rather indistinctly.

The normal œsophagus has **three narrow places:** first, at the annular cartilage; 2d, in the region of the bifurcation, and 3d, in the region of the hiatus.

The examination of the œsophagus is possible first, by **œsophagoscopy,** which is comparatively little used, and of value (and without danger) only in the hands of an experienced examiner; secondly, the usual method of examination is with a **probe or sound.**

Sounding. The examination with the sound has to be executed **very carefully,** feeling one's way, so to speak, to be able to follow the course of the œsophagus, which is not straight, and at the same time to feel any abnormal resistance, as strictures, etc. For sounding, English bougies are used, which are softened by immersion in warm water and modelled into the desired curve before insertion. Before the sound is introduced the patients should **remove** any **artificial teeth or bridges,** if present,

and **aneurism of the aorta,** which is a strict **contraindication,** must be excluded. The patient should sit with his head straight or slightly inclined forward. The left index of the examiner presses down the tongue of the patient and the right hand slowly shoves the sound over the epiglottis. The patients usually gag and hold their breath. They must then be asked to breathe quietly and deeply. After the sound has entered the upper part of the œsophagus, the patient should move the head backward to straighten the œsophagus.

The distance of the different parts of the œsophagus from the teeth may be seen in the following table (after Bergmann).

TABLE OF MEASUREMENTS OF ADULTS.

	MEN.			WOMEN.		
	Variation, in Inches.	Average.	Most Frequent.	Variation, in Inches.	Average.	Most Frequent.
Distance of commencement of œsophagus from teeth	5½ to 6¼	5⅞	5⅞	4⅜ to 5⅞	5⅜	5½
Distance of bifurcation from teeth	9 to 11⅜	10¼	10¼	8⅝ to 10⅝	9⅜	9⅜
Distance of cardia from teeth	14⅛ to 19⅝	15⅝	15⅜ and 16⅛	12½ to 16⅛	14⅝	14⅛ and 15¼

TABLE OF MEASUREMENTS FROM CADAVERS OF NINETEEN CHILDREN.

AGE.	Distance from Teeth— to Lower Edge of Cricoid Cartilage.	to Bifurcation.	to Cardia.	Total Length of Œsophagus.	Length above Bifurcation.	Length below Bifurcation.
9 days	2⅜	4⅜	6⅝	3⅞	2	2
6 weeks	2⅜	4¼	7	4⅝	2	2⅜
3 months	2⅞	4⅞	7⅜	4½	2	2½
8½ months	3½	5	7⅞	4⅜	2	2⅜
14 months	3⅞	5½	8⅜	4⅜	1½	3⅛
15 months	3½	5½	8⅜	5½	2⅜	3⅛
21 months	3⅞	5⅞	9	5⅛	2	3⅛
2 years	..	..	...	5½	2	3⅜
2 years	3½	6⅜	9⅜	5⅞	2⅞	2⅞
3 years	..	..	...	5½	2⅜	3⅛
4 years	..	..	...	5⅞	2⅜	3½
5 years	3⅞	6⅝	10¼	6½	2⅜	3½
6 years	4¼	7½	11	6⅝	3⅛	3½
9 years	..	..	...	6½	2⅜	3½
9 years	4¼	7½	10⅝	6¼	3⅛	3⅛
11 years	3⅞	7	11	7	3½	3⅞
12 years	3⅞	7	11	7	3⅛	3⅞
14 years	4¼	7⅜	12½	7⅜	3½	4⅛
15 years	5½	9	13	7½	3½	3⅞

Foreign bodies enter the œsophagus usually by **accident,** except in the case of insane persons and showmen. Needles held between the lips Foreign bodies.

frequently enter the œsophagus. Sometimes too large pieces of unmasticated meat or potatoes become lodged.

More frequently hard parts of the food, as fish or other bones, become wedged. In small children any object may be found. In grown people, by far the most frequent accident is the swallowing of artificial teeth. This happens also in narcosis, if they have not been removed before beginning the same.

The foreign bodies usually become lodged in one of the normally narrower places of the œsophagus named above.

Symptoms. The symptoms depend upon the **site and size** of the foreign body. If the latter is fast in the upper part, attacks of suffocation may ensue. If a large soft body occludes the œsophagus farther down, food is regurgitated. In most cases, though, fluids can pass. **Swallowing** is then **accompanied by pains** in the region of the sternum (these pains may continue even after the foreign body has been removed). It is to be noted that sometimes the presence of foreign bodies may give practically no symptoms, even for a long while.

Usually the patients **gag and vomit,** and may thus throw up the foreign body. If the foreign body stays in the œsophagus for any length of time, necrotic ulcers and perforation, with all its sequelæ, are probable.

The **diagnosis** rests on the history, the result of the sounding, eventually œsophagoscopy. *X*-ray pictures may be of great help.

DISEASES OF THE ŒSOPHAGUS.

Inflammations of the Œsophagus.

By far the most frequent and important inflammation of the œsophagus is that caused by **swallowing corrosive chemicals,** either by accident or suicidal design. They are either strong alkaline solutions or acids, as carbolic, nitric, sulphuric, hydrochloric acid, or solutions of sublimate, etc. The corrosion is then found in the mouth and pharynx, as well as in the œsophagus.

Ulceration. In those which for various reasons are not at once fatal, **ulcers** will form, which finally heal in scars, producing annular or tubular **strictures.** Sounding for strictures is not to be undertaken as long as the ulcers are not healed, which takes about three or four weeks.

Besides these corrosive ulcerations, **decubital ulcers** occur as the result of pressure; for instance, by a tumor which presses the trachea

against the œsophagus in such a manner that decubitus results. This sort of decubitus occurs in **cachectic patients** in the last stages, by the pressure of the larynx on the œsophagus.

Syphilitic and tuberculous ulcers are extremely rare.

A peptic or **round ulcer** of the œsophagus has been observed, which is analogous to ulcer of the stomach. It occurs only in the **lowest part** of the œsophagus and is usually small, round, or oval.

Stricture.

These ulcers result in stricture at the above-named places of predilection; **above the stricture** we usually find **dilatation.** The dilated part, as well as the stricture itself, is usually not smooth; frequently we find ridges, bridges, and pouches, which may interfere with the introduction of the sound. Special care ought to be exercised to prevent a false passage.

The **principal** symptom of the stricture is produced by the fact that the **œsophagus is not freely permeable.** The patients not only throw up any food that is not fluid (and even that, if too large a quantity is swallowed at once); but in narrower strictures much mucus and swallowed saliva collects above the stricture, and the patients are greatly inconvenienced and exhausted by constantly vomiting frothy fluid and thick tough mucus. Pain is usually present as long as the ulcers exist.

Differential diagnosis.

The differential diagnosis between strictures produced by scars and those of carcinomatous origin is easy, if œsophagoscopy is used. If that is not feasible, we may get particles of tumor, which have been caught in the fenestra of the stomach-tube; otherwise we have to rely on anamnestic data and the cause of the disease.

We have to include in the diagnosis the question, "When is an **operative procedure indicated?**" Generally speaking, an operation is necessary if it is otherwise impossible to feed the patient *per os;* that is, if the sound cannot be passed through the stricture at all, or if the stricture cannot be dilated as far as necessary.

Which of the operations is to be preferred, whether internal or external, or combined œsophagotomy, or extirpation of the stricture, or gastrotomy, has to be decided according to the case. We might only mention here that gastrotomy (making a stomach fistula) is to be recommended in many cases to insure proper nourishment during the sound-treatment, even if the œsophagus is still partly permeable.

Ectasia of the Œsophagus.

Dilatation.

We **differentiate** the spindle-form or diffuse dilatation of the œsophagus, and diverticulum of the same. The dilatation of the œsophagus may attain very large dimensions, so that it sometimes holds 1500 c.c.

The principal symptom is the evacuation of food without any real vomiting, shortly after the meal, or later. Regurgitation is quite frequent, and the examination with the **stomach-tube** reveals the condition at once. As soon as it gets into the dilatation filled with food, copious disintegrated masses are evacuated, the **chemical examination** of which never shows the presence of free hydrochloric acid, pepsin, or rennet-ferment.

Diverticula.

Diverticula of the œsophagus are **rare,** but if present, have such **characteristic symptoms** that they can hardly be overlooked. If the diverticle is well developed, which occurs only after a long period of indistinct symptoms, food will get into the same and produce the **symptoms of dilatation.** The patients can usually empty the sac by pressure on the œsophagus. Frequently they have to assume a special position to get the food down into the stomach. The decompositon of food in the sac produces sometimes unbearably **foul breath.** If the sac is well developed and filled with food it will, of course, appear as a tumor of the neck.

Diagnosis by the sound.

The sound usually shows the condition easily. It is arrested at a distance of nine and a half inches, but in **contrast to the stricture** the end of the probe is freely movable in the sac. It is **characteristic** that during one examination the sound may pass into the stomach without any trouble, the next time it becomes arrested (goes into the sac). Roentgen pictures may be of value, especially if we give the patients, for instance, mashed potatoes mixed with bismuth.

Tumors of the Œsophagus.

Benign tumors of the œsophagus are extremely **rare,** and usually create so little disturbance that they may be neglected.

Carcinoma.

The **carcinoma** is by far the most frequent and important neoplasm of the œsophagus. It occurs most frequently after the fiftieth year, and more often in men than in women.

The principal symptom is **disturbance of deglutition,** corresponding

to the slow development of an increasing stenosis. First, solid food does not go down entirely, and has to be washed down by a drink of water, but soon solid food regurgitates, while fluids go down with a gurgling sound. Tough **mucus,** sometimes with thin bloody stripes of very bad odor, is frequently evacuated. Symptoms.

The **second important symptom is pain** of a burning or compressing character in neck and chest, especially during swallowing.

The stenosis as well as the malignant process soon produce **cachexia.**

Of **other symptoms** we have to mention small pupil on the affected side; if the recurrent nerves are involved by the growth, severe dyspnœa occurs. The **diagnosis** rests on the anamnesis. Palpation may sometimes show a tumor of indistinct hardness. The latter is usually due to carcinomatous glands and not to the tumor itself. The sound is of great value; sometimes the tube will bring up small masses of tumor. Œsophagoscopy, if well done, doubtless gives the best information.

INJURIES AND DISEASES OF THE PERITONEUM.

INJURIES OF THE PERITONEUM.

Injuries and diseases of the intraperitoneal abdominal organs produce in so many cases peritonitis, that it may be well to describe the latter first.

Question of infection of greatest importance.

Injuries of the peritoneum are only in so far of importance as the question arises, "has infection taken place?" The latter may occur either from outside, or from a perforation of any of the intraperitoneal organs, which may have been injured at the same time.

The peritoneum presents peculiar conditions, first, by its vast extent and the rapidity with which inflammations may spread; secondly, by its power of rapid absorption, which is of great value as long as infectious material has not been introduced in too great amount, when this same beneficial quality becomes nefarious by the quick absorption of large quantities of toxines; and thirdly, by its quality of answering insults, either mechanic or toxic, by effusion. As soon as the **diagnosis of an injury** of the peritoneum has been established, with the probability that an internal organ or a vessel has been injured, immediate laparotomy is indicated, if this can be done according to aseptic rules.

Peculiar nature of peritoneum.

Internal hemorrhage is recognized by increasing pallor, small, frequent pulse, fainting, and cold sweat; and slight symptoms of irritation of the peritoneum are frequently present.

The question, if the **intestines have been injured,** is much harder to decide and should be determined by exploratory laparotomy, because if we wait for signs of developing peritonitis from an existing perforation, the patient is usually lost.

Subcutaneous intraperitoneal injuries.

Subcutaneous intraperitoneal injuries happen **without a wound** of the peritoneum itself. The large, solid organs, as well as the hollow organs, if well filled, may burst by direct or indirect force. The symptoms are then those of hemorrhage, and later on of perforative peritonitis.

The injury is much harder to determine than in the case of open

abdominal wounds. First, **shock symptoms** prevail; if those do not subside, but continue internal, hemorrhage is probable. **Symptoms of perforation** usually do not develop until from six to twelve hours after the injury.

INFLAMMATIONS OF THE PERITONEUM.

Peritonitis is in nearly all cases secondary, so that we can really say it is a **symptom of another disease.** The diseases which may produce peritonitis are very manifold. By far the most frequent cause is **appendicitis.** In many of these cases only circumscribed local peritonitis will result, while in those more violent, general peritonitis develops. Causes.

After appendicitis, **perforating ulcers** of the stomach and duodenum are the next frequent cause. The ulcers of the gut may be due to typhoid or to tuberculosis, or in the colon to syphilis. Foreign bodies may also cause perforation. **Other etiological factors** are occlusion of the bowel, as in internal or external hernias, obstruction of the gut by bands, volvulus, and invagination, or thrombosis of mesenteric vessels.

The **female organs,** uterus, ovary, and tube are frequently responsible for peritonitis, either during the puerperium or by a gonococcus infection.

The **gall-bladder and liver** infect the peritoneum, the former by gallstones, the latter by perforation of an abscess.

The **pancreas,** if in an inflamed, suppurative, or necrotic condition, may cause inflammation of the peritoneum.

The **mesenteric glands** may also be responsible.

In the new-born an **infection of the navel-wound** may be carried on into the peritoneum.

In rare cases the inflamed **prostate** may be responsible.

Pleuritis and pericarditis may be carried on into the neighboring peritoneum.

Tuberculous and carcinomatous peritonitis will be described later (see pages 153 and 154).

The symptoms on which we base our diagnosis are so **characteristic,** that the experienced examiner will be able to make his diagnosis by inspection only. General symptoms.

In **acute peritonitis** patients feel at once very ill; usually the onset is introduced by a chill. The **expression** is anxious and restless; later, the face is sunken in, the nose is pointed, its tip cool; later still, cyanosis of the face is apparent. The patients lie flat on the back with knees

drawn up, and as a sign of restlessness they throw the head and arms from one side to the other.

Euphoria. The **sensorium** is first clear, later, the patients become delirious. Toward the end a **typical euphoria** occurs, where the patients do not feel or complain of any more pains; they feel generally relieved and much improved. The sunken-in face, the cyanotic and cool extremities, cold sweat, thread-like pulse, show plainly that this fallacious euphoria is a sure sign of approaching death.

Respiration is superficial, only costal, the patients repressing abdominal breathing; it is therefore frequent.

The **pulse** is very characteristic, independent of the temperature; it is of increasing high frequency, small, and of low tension.

Sometimes it seems as if the heart did not have the strength to react with a high pulse, so that a low pulse in rare cases may exist during peritonitis.

Temperature. The **temperature** is the least reliable symptom. While in well-developed cases of puerperal fever the temperature usually is very high, 104° and 105°, in many other forms of peritonitis, as, for instance, with appendicitis, high temperatures are not the rule, and the course of the temperature is so atypical and irregular that its **atypical form has been recognized as typical.** Insignificant rises from 100½° to 102° (the highest point is often reached in the morning and not in the evening), with occasional sharp exacerbations for one day, are the rule, and only the **relation between pulse and temperature** gives diagnostic information. The pulse often is 120 and 140, quite out of proportion to the temperature of 101° or so. In fact, frequently the temperature falls while the pulse rises (**dangerous crossing** of the temperature and pulse-curves on the chart).

The entire **intestinal canal** is **paralyzed.** Complete loss of appetite exists, and there is distressing thirst, which cannot be satisfied, even if quantities of fluid are given.

The **tongue** is thickly coated, soon becomes dry and in septic cases brown and cracked. The moist tongue in peritonitis is always a good sign.

The quantity of **urine** is small, it is highly concentrated, and shows albumin and indican.

Local symptoms. The local symptoms **depend upon the stage** of the disease. The pain is not always localized, at least at the beginning, to the spot from which peritonitis started. Frequently the patients complain of indis-

tinct **pain** all over the abdomen, and in appendicitis, for instance, the first peritoneal irritation (even long before perforation) is indicated by a pain around the navel. If then a circumscribed peritonitis follows, the pain becomes localized, but in general peritonitis it is everywhere.

The **muscles** of the abdomen become rigid, as hard as a board, making even careful examination impossible.

The **paralysis of the intestinal tract** is indicated by complete obstipation, so that fæces and flatus are retained. This produces meteorism (some rare forms of peritonitis show profuse diarrhœa), the abdominal wall bulges over the sternum, the liver is displaced upward, and its free edge stands forward.

In many cases **ascites** forms if there is time for its development.

Septic toxæmia usually produces dry peritonitis.

The nature of the exudation, if serous or purulent, can be verified only by (dangerous) exploratory puncture.

Vomiting, preceded by nausea, and singultus are nearly always constant, and may become uncontrollable.

Frequently the configuration of several loops of the intestine can be seen through the abdominal wall, and in cases of intestinal obstruction, retrograde peristaltic action can be observed.

The diagnosis, according to the symptoms described, can hardly be missed.

Vomitus niger and stercoral vomiting are always a very bad sign.

Differential diagnosis.

The only differentiation which may become difficult is between peritonitis and ileus. Many symptoms are common to both, but in **ileus** (as long as it is not complicated by peritonitis) the abdominal walls are less stiff, the tenderness is less diffuse, and more localized to the spot of occlusion. Peristaltic and antiperistaltic action are more pronounced in ileus. There is at first no fever connected with it, and the general condition of the patient is in the beginning not so grave, in fact, sometimes apparently so good that an occlusion may be overlooked.

Indication for operation.

The indication for operation varies with the different **primary diseases** of which peritonitis is, as I said above, only a symptom. Therefore one should never be satisfied with the diagnosis of peritonitis, but always endeavor to make out the disease at the bottom of it.

If a **perforation of an organ** is the cause of the peritonitis, immediate closure of the perforation is of course essential, but the treatment proper of peritonitis with large exudation, especially if purulent, is evacuation of the pus and mechanical cleansing of the abdominal cavity,

so that only the line of incision differs in the different forms of peritonitis.

Shock is no contraindication for operation, on the contrary the best treatment of shock is early operation. How **extensive** the operation is to be—if, for instance, removal of a gangrenous loop of the gut, etc., is advisable in the first step of the operation—has to be decided from case to case.

Circumscribed form.

The **circumscribed form of peritonitis** usually shows less violent symptoms than general peritonitis. The septic general intoxication is usually lacking, or exists only for a short while.

The surgical treatment of this form shows, of course, much better results, especially as operation, without opening of the general peritoneal cavity, is frequently possible.

The **subphrenic abscess** is caused on the **right side** by diseases of the appendix, of the liver and gall-bladder, or of the right kidney; on the **left side,** it is due to infections starting from the stomach, duodenum, spleen, left kidney, or left lobe of the liver.

Symptoms.

The symptoms are sometimes not very clear, but generally present a picture of a circumscribed peritonitis. On the right side **three differential sounds are characteristic:** in the upper part of the thorax, normal lung sound, then tympanitic sound from the presence of gas in the abscess, and lower down, liver dulness. If pleuritic exudation or empyema exists at the same time, **differentiation** may become very difficult. **Exploratory puncture,** especially if repeated, will help considerably in establishing the diagnosis. Only the presence of pus indicates operation.

Chronic peritonitis becomes of special interest by the formation of string or band-like **adhesions,** which may lead to internal incarcerations and thus necessitate operation. This is the more permissible, since we know that the eventual new adhesions are not of any long duration.

Tuberculous peritonitis.

A special form of peritonitis is the tuberculous peritonitis. It is a miliary tuberculosis of the serosa, or a tuberculous infection of the same.

Clinically we find either an abundant exudation or the formation of comparatively large lumpy tumors. The disease usually attacks young individuals, especially children, and its course is chronic. The **principal symptom** is the exudation, which will not be freely movable if penned in by broad adhesions.

If tuberculosis is evident in other organs, the **diagnosis** becomes

more probable. As soon as the diagnosis is made out with any probability, laparotomy ought to be advised, as it is a fact that many of these cases are cured by simple opening of the abdomen.

Carcinomatous peritonitis is in some cases a primary disease of the peritoneum; most frequently, though, it is a secondary affection due to carcinoma of some of the intraperitoneal organs.

Ascites (accumulation of serous fluid in the abdominal cavity), without inflammation, is due to general **stasis** in the circulatory system, to local stasis in the region of the abdominal vessels, or to general hydræmia accompanying diseases of the kidney. Ascites.

The presence of ascites is proven by **dulness** in the lower stratum of the abdominal cavity, which changes with the change of position; snapping of the fingers against the abdominal walls usually produces a wave of **fluctuation,** which can be felt in the opposite side. Puncture of the ascites, if it has become necessary, may have to be repeated frequently.

INJURIES AND DISEASES OF THE ABDOMINAL WALLS AND THE NAVEL.

INJURIES OF THE ABDOMEN.

Contusions.

Injuries of the abdominal wall are either contusions or wounds. The former are of no special consequence or interest, except in those cases where, after a simple contusion without any apparent injury to the intra-abdominal organs, severe shock or even death results. The latter seems to be the result of **reflex alteration of the vasomotor centre.** This condition of severe shock has to be differentiated from internal hemorrhage, which necessitates immediate laparotomy.

Besides this, a **tear in the subcutaneous muscles** may occur, especially in the rectus. It will be recognized by the subcutaneous hemorrhage, swelling, tenderness, and diastasis of the muscles.

Wounds.

The wounds of the abdominal walls are either non-penetrating or penetrating. Superficial extensive wounds may be due to burns by heat, acids, etc., or to congelations. The penetrating wound may either simply penetrate the wall alone, or involve an intra-abdominal organ.

Of special interest are those cases where patients have been impaled.

The wounds by cut and shot, especially the latter, are always penetrating.

INFLAMMATIONS OF THE ABDOMINAL WALL.

Inflammations of the abdominal wall may be either primary or secondary; in both cases they are recognized by local tenderness, fever, etc.

Actinomycosis.

Actinomycosis can be recognized only, if, first, a somewhat hard swelling develops in the abdominal wall; finally the reddened skin breaks open and discharges the specific pus, in which actinomyces can then be found.

TUMORS.

Nearly all the different kinds of tumors occur in the abdominal wall, but show no special characteristics. They correspond to other tumors of the surface of the body.

Of special interest are only the so-called desmoids, tumors which start from the tendons and the aponeurosis. They are hard, of smooth surface, and grow in the direction of the muscles to which they belong. If they are deeply situated and assume any size, they may be mistaken for hæmatomas or other tumors, but they are **painless,** can be more distinctly differentiated from the surrounding tissue than other growths, and cause no fever, and the history does not reveal any other organic disease. Desmoids.

Retroperitoneal tumors have intestinal sound over them, and the gut can be inflated above them.

The differential diagnosis from tumors and cysts of the female organs can be established by examination from the rectum and vagina.

Dermoids occur only on the navel.

DISEASES OF THE UMBILICUS.

Congenital disorders may lead to two different kinds of **fistulæ** at the navel. First, the **omphalo-mesenteric;** if the canal which connects the intestinal tract and the omphalo-mesenteric duct remains open, the mucous membrane of the gut then lies on the surface and discharges mucus or fæces. Fistulæ.

The other kind of fistula is formed by persistence of the **urachus.** Sometimes these fistulæ are so large that a part of the bladder may collapse.

The **inflammations** of the navel in the new-born are either simple eczema, or inflammation of the vessels of the navel, or phlegmon, or erysipelas.

Inflammatory fistulæ of the navel may be due to diseases of the intestine, bladder, liver, or gall-bladder.

Tumors of the Navel.

The **fungus umbilici granuloma** develops after the cord has fallen off and appears as a granular tumor of the size of a pea, frequently pedicled. The **surface** of the little tumor, which may be buried under the folds of the skin, is usually **covered with pus.** This **differentiates** it from the **enteroteratoma,** a small pedicled reddish tumor growing out of the navel and reaching the size of a raspberry. Granuloma.

Both the granular tumor and the enteroteratoma have no fistulæ, in contrast to the omphalo-mesenteric fistulæ.

Sarcomas and carcinomas occur also in this region, but are very rare.

INJURIES AND DISEASES OF THE STOMACH.

EXAMINATION OF THE STOMACH.

Examination of the patient for a possible disease of the stomach is exceedingly difficult, for a great many reasons. The subjective symptoms, which usually lead the patient to the physician, are manifold and of varying value. Among these we may mention loss of appetite (anorexia), which is in hysterical and neurasthenic patients frequently the disease itself, abnormal hunger (bulimia) (also frequently the principal symptom of neurosis), increase of thirst, and pain.

Pain. Pain in the stomach is a very **frequent symptom.** Its value depends on the observation of the patient, as well as of the examiner. It is frequently ascribed by the patients to the stomach, while it has its origin in an entirely different region. It may be either spontaneous or caused by pressure; for the latter see palpation.

The real gastralgia may be either continuous or periodical. The typical severe attacks occur either suddenly, or are preceded by manifold other gastric disorders, as nausea, eructation, and pressure in the region of the stomach. This is followed by an attack of pain, which is described sometimes as boring, cutting, or piercing. If pressure increases the pain, the patients try to relieve the pressure by bending forward; the pulse is small and accelerated. If the attack lasts any time, collapse is sometimes observed.

The pain is of most value as a **symptom of ulcer,** while carcinoma frequently develops without pain. In both cases, especially in **ulcer, the pain** is usually **localized** to a circumscribed region, generally that of the pylorus. In many forms of gastritis the pain extends over the entire stomach.

Cardialgia. In **nervous pain** in the stomach (cardialgia) the pain is either diffuse or localized; in the latter case it is diminished by external pressure, in contrast to the pain in ulcer.

Cardialgia, occurring periodically combined with violent vomiting, is frequent in locomotor ataxia (tabes dorsalis).

Of **great importance** is the temporal relation between meals and the

occurrence of pain. If the pain occurs constantly at certain intervals (one-half to two hours after meals) we have to deal with an ulcer. An ulcerating cancer of the stomach may, of course, produce the same symptom. Time when pain occurs.

If the onset of the pain is not influenced by a meal, a correct inference in regard to the character of the disease is not possible. Frequently it is a sign of nervous cardialgia with hyperæsthesia of the mucous membrane.

Heartburn (pyrosis) occurs in many, but by no means all, cases where abnormal fermentation takes place. It usually indicates an **increased acidity** of the contents of the stomach. The latter may be due either to an abnormal **formation of organic acids,** as lactic acid and sebacic acid, which both occur especially where hydrochloric acid is present; or it may be due to an abnormal **production of hydrochloric acid,** which either may be a disease by itself, or occur in combination with other diseases, especially ulcer or gastrectasia. Heartburn.

In some cases heartburn occurs without hyperacidity.

Eructation.

Eructation is frequently regarded as an abortive form of vomiting, because it generally occurs in diseases of the stomach where vomiting is present, but it is usually due to the **accumulation of gases** in the stomach. If particles of food are brought up with the gas, we call it regurgitation. In gastralgia, eructation is especially frequent, and the gases usually have a bad, sour odor.

Vomiting.

We distinguish two different kinds of vomiting according to their origin, central and reflex vomiting.

Central vomiting is observed in meningitis, and other diseases of the sensorial apparatus, especially the brain; it also occurs in locomotor ataxia and migraine. Besides this, central vomiting may be due to intoxication, either auto-intoxication (uræmia and diabetes mellitus) or from the introduction of toxic substances (alcohol, morphine, chloroform, ether, arsenic, phosphorus, and metallic salts).

Reflex vomiting occurs in a great many diseases of the stomach. Besides this, **other abdominal organs** may produce it; thus we find it in

peritonitis, occlusion of the intestine, colics due to stones in kidney or gall-bladder, gravidity, and other conditions.

The throwing-up of too hastily consumed nourishment is not to be considered true vomiting. The latter occurs in small children too, as in meningitis, etc., but is then always accompanied by retching.

Methods of Examination of the Stomach.

The physical examination of the stomach is carried out by:

1st. Inspection.
2d. Palpation.
3d. Percussion.
4th. Auscultation.
5th. Distention.

The functional examination is made by means of the stomach-sound, to ascertain, first, the motor function, and secondly, the secretory function.

Inspection.

1. **Inspection.** Only under abnormal conditions does inspection reveal the **size** of the stomach. The epigastrium shows sometimes marked distention, which is usually not produced by a tumor of the wall of the stomach, but is rather due to the presence of an abnormal quantity of gas bulging out the stomach. Imitating this condition we inflate the stomach artificially. Cf. below. The **contours of the stomach** are then distinctly visible through the abdominal wall. In gastroptosis the epigastrium is not filled out, in ectasy the entire region, up to the ensiform process, is distended.

Peristaltic motions are sometimes visible, especially when one taps on the stomach. The wave of peristalsis moves from left to right. If the motions are very energetic or reversed, they indicate an obstruction in the pylorus region.

Gastroscopy.

Inspection of the stomach is also carried out from within by the optic method of gastroscopy; the latter method, similar to cystoscopy, is rather difficult and therefore not much used. All **other methods,** like diaphanoscopy and examination by *x*-ray, are **without any practical value** whatsoever. *X*-ray photographs sometimes give a shadow where a very marked tumor is present, but then such a tumor can also be felt.

2. **Palpation.** Palpation of the stomach is by far the **most important diagnostic** measure, but it is also by far the most difficult. Only through long practice can we achieve any reliable results. Palpation is

to show two things, first, the presence of tumors, and secondly, to prove pain on pressure at certain points.

Manner of carrying out palpation.

The patient must **relax** the abdomen; the dorsal position with slightly raised head is therefore the most suitable. If patients stiffen the abdominal muscles, we let them pull up the knees, open the mouth slightly, breathe deeply and quietly; we then use the inspiration for palpation, especially in crying children. The two hands of the examiner (always to be used together) are slightly flexed; so are the fingers. To feel the edges of the tumor the fingers are still more flexed and pressed downward. If we need **strong pressure** we put one hand over the other and palpate with the lower one. Usually a slight pressure is more efficient, as it does not cause contractions of the abdominal muscles.

Differential diagnosis.

For differential diagnosis between tumors of the **stomach** and those of the **kidney**, we put one hand in the loin and one hand on the abdomen to examine bimanually. In exceptional cases we use narcosis to relieve the abdominal tension.

The abnormal **resistance** may be due either to contractions of the muscles, especially the rectus or one of its segments, or to a real tumor. In all cases of pain we have to exclude epigastric hernia and a preperitoneal lipoma.

The **epigastrium** is normally **tender** on pressure, and this tenderness is not necessarily increased, but it may be markedly so in any disease of the stomach. It is most constant and **characteristic in ulcer** of the stomach.

Pain as a diagnostic factor.

Spontaneous pain is usually **increased by pressure** in organic diseases of the stomach, as ulcer, carcinoma, or gastritis, but in **nervous conditions** of the stomach the pain is sometimes **diminished** by pressure from outside. In the same condition the faradic current may have a similar effect. In gastritis and nervous cardialgia the pain is usually **diffuse** over the entire stomach, and most intense in the epigastrium, while in ulcer and cancer the pain is usually **localized** to a small circumscribed spot. Patients with ulcer frequently describe the pain as shooting with great intensity toward the spine. Some of the internal clinicists attach great weight to **different points,** tender on pressure in the spine. The **pressure-point characteristic for ulcer** is a little to the left of the spine close to the body of the twelfth dorsal vertebra. The point characteristic for **gall-stone** is at the same height, but two to three fingers' width distant from the spine. These diagnostic points are doubtless of value, but not infallible, as a number of operations have proved.

Splashing sound.

The splashing sound is produced by alternate quick, short blows with either hand on the walls of the stomach. We then hear and feel distinctly the swashing of the fluid contents of the stomach. It usually indicates **gastrectasia,** but as it occurs in the normal stomach also, its diagnostic value must not be overrated.

3. **Percussion.** Percussion is not of great diagnostic value. The boundaries of the stomach cannot be made out by percussion, especially is it hard to **differentiate the stomach from the colon;** the former can better be marked out by percussion with the patient in different postures, lying on his back and standing. With the patient supine we get, where the stomach touches the abdominal wall, a deep tympanitic sound, due to the air which is always present in the stomach. If the patient then gets up, the fluid contents of the stomach sag, and therefore the tympanitic sound disappears, and a dull sound appears at the same spot. This usually indicates the lower edge of the stomach.

How to find the limits of the stomach.

4. **Auscultation.** Auscultation has so far not been used to any advantage, except that the **splashing** (**succussion**) **sounds** are of some value. If they occur in the jejune stomach or below the umbilicus, they indicate mechanical insufficiency.

5. **Distention.** Distention of the stomach is made for the purpose of demonstrating the **site, size, and configuration** of the stomach.

Distention.

It is effected in two ways: by giving the patient a small teaspoonful of **bicarbonate of soda,** and immediately afterward one-half teaspoonful of **tartaric acid,** each in two to three ounces of water. Thus we have not to insert the stomach-tube; but as the effect of this method is not absolutely certain and not entirely without danger, the stomach-tube should be ready to relieve the patient of carbonic acid if necessary.

The better method is to blow up the stomach with air through the **stomach-tube;** the amount of air can be regulated. We can then use palpation and percussion, to find the borders of the stomach, and abnormal contours, like the "hour-glass stomach" can thus be demonstrated. Inflation of the stomach is always effective, except in cases of very strongly developed abdominal walls and incontinence of the pylorus or the cardia.

Inflation of the **colon** may be of great value in **differential diagnosis.** This is done in the most simple way by inserting a rectal tube, to which an inverted mineral-water siphon is attached, thus the carbonic acid gas escapes into the tube without any water following.

Functional examination.

The **functional examination** of the stomach is carried out, first, by

examination with the stomach-tube, and secondly, by microscopical and chemical examination of the contents of the stomach.

Value of the stomach tube.

The use of stiff stomach-sounds has been entirely given up. We now use only the soft stomach-tube, of not too small a calibre. The stomach end ought to be closed, with two lateral openings near the closed end. With this tube we can ascertain, first, **stenosis** of the cardia, if present; second, the **motor conditions** of the stomach; third, the **secretory function** of the stomach by chemical examination of the removed contents of the organ; and fourth, the **greater curvature** can be made out either by filling the inserted tube from outside or by *x*-ray photographing the tube (filled with fine shot or bismuth) *in situ*.

The use of the **sound is absolutely contraindicated** immediately or even some time after a hemorrhage. If ulcer is probable the tube must be used with great caution.

If we want to ascertain the **motor function,** *i.e.*, to find out in what time the stomach has been emptied of a meal, we wash out the stomach with the tube, filling the funnel twice with about one pint of lukewarm water each time.

Chemical examination.

If we want to make a chemical examination of the stomach, especially to determine the percentage of acid, we use the **expression method,** thus gaining the contents of the stomach without any dilution. If the latter method is used, the tube is not to be removed until we pour, after the expression, lukewarm water into the elevated funnel, thus preventing tearing out the mucous membrane of the stomach wall, which otherwise is drawn into the fenestra by suction.

To find out the motor power of the stomach we give a **test-meal,** consisting of one roll, and ten ounces of water or tea. After one hour and a half, or at the latest two hours, what remains in the stomach should be removed; if the stomach is empty after one hour, it is abnormal.

This same test-meal can be used for **chemical examination,** in which the presence or absence of hydrochloric acid, pepsin, pepton, rennet-ferment, lactic acid, and sebacic acid can be proven. We cannot enter here into the methods of chemical examination.

Microscopical examination.

The microscopical examination has to observe especially the different kinds and the number of microbes. Of special importance are the lactic acid bacilli, saccharomyces, and sarcinæ.

Of **congenital anomalies** of the stomach, which are rare, it is sufficient to mention congenital stenosis of the pylorus.

INJURIES OF THE STOMACH.

Subcutaneous Injuries.

The lighter forms of subcutaneous injuries and neighboring lesions either do not come under observation, or if they do, have frequently such indistinct symptoms as to prevent exact diagnosis.

Rupture of the stomach.

Much more important is rupture of the stomach. This occurs almost exclusively on or very near the **lesser curvature** up to the pylorus, usually nearer the latter, and not rarely on the anterior wall, very rarely in the fundus or on the greater curvature. Usually the stomach is overdistended by fluids or solid food.

The symptoms are usually striking, and consist of:

1st. Shock.

2d. Local symptoms of the perforation.

3d. Infection of the peritoneal cavity.

Symptoms.

First of all, if the patient has not lost consciousness, he feels a **violent pain,** usually at the site of perforation, after which shock ensues, which sometimes leads to death.

The intense pain is not increased by pressure, vomiting is not always present, and the vomitus when present may contain blood.

The **abdominal muscles** are stiff and as hard as a board, and the abdomen is **concave.** If this latter symptom persists, perforation of the stomach is very probable.

Soon the presence of **contents of the stomach in the abdominal cavity** is evident. When the patient is supine the highest point of the abdomen is the middle of the epigastrium, where even small quantities of escaped **gas** can be traced by the **tympanitic sound.** The **fluid** sinks to the lower parts of the peritoneal cavity and reveals its presence by **dulness.** Later on perforative **peritonitis** develops, the abdomen becomes distended, generally tender on pressure, the pulse becomes small, frequent, and soft; the temperature may rise, the intestines are paralyzed, and vomiting becomes constant. Of all these symptoms the **presence of gas** is by far the **most important.**

Differential diagnosis.

The differential diagnosis between rupture of the **stomach** and rupture of the **bowel** may be extremely difficult, if not impossible; but for practical purposes it is sufficient to make a diagnosis of intestinal rupture, which makes immediate operation necessary.

Sometimes the course of the perforation is not so violent as described above, but even then the **operation** is fully as necessary. As to waiting for the passing of the shock, a few hours are sufficient; after that an operation, if we have made a probable diagnosis of perforation, ought not to be delayed any longer. Time of operation.

The question of transportation of such a patient has to be decided, as it is usually necessary (except in cases where the perforation occurs in the hospital), and if so, the sooner the better.

Penetrating Abdominal Wounds with Wounds of the Stomach.

They are usually caused by stabbing or shooting. Stabbing may produce only one wound, while a bullet usually produces an entrance and an exit wound.

The **abdominal wound** usually **facilitates the diagnosis** of the wound of the stomach materially. Wounds of stomach from outside.

The dangers mentioned above as connected with perforation of the stomach are augmented in these injuries by the probability of serious **hemorrhage.** Immediate operation in all these cases is necessary.

Injuries of the Stomach from Inside.

They are the result either of foreign bodies (cf. below) or of caustic fluids. In some cases perforation has been effected by the passage of stiff stomach-sounds. Wounds from inside.

The **caustic injuries** by acids or alkalies necessitate, besides the dispensing of antidotes, an operation according to the degree of destruction of mucous membrane or perforation. The stomach-tube has to be used in those cases with the greatest care.

Foreign Bodies.

They are usually introduced through the mouth, either intentionally by hysterical or insane persons or with suicidal intent, or by mistake, especially in the case of children. All sorts of **foreign bodies** have been removed from the stomach, as pins, tacks, coins, artificial teeth, fish-bones, stones, fruit-stones, beads, rings, pieces of wood, knives, forks, spoons, scissors, sword-blades (in show-men), pieces of glass, etc. Besides this, we have to mention the **bezoar,** a tumor formed in the stom-

ach, consisting of hair, especially in girls who chew their braids. Carpenters who drink furniture polish may have **stones** in the stomach formed by shellac.

A great many of these foreign bodies give comparatively few symptoms, and some of them may have remained in the stomach for a long while.

Murphy buttons used in gastro-enterostomy may drop into the stomach instead of passing into the bowel; since the anterior method has been neglected in favor of the posterior, this can no longer happen.

The **diagnosis** may be very difficult if the anamnesis is unreliable. The **radiogram** is about the only reliable diagnostic help.

Operation usually not urgent.

Even if the presence of a foreign body in the stomach has been established, only in the very rarest instances will immediate **operation** be necessary. In a great many cases even the most improbable foreign bodies will pass the entire intestinal tract and be finally expelled *per vias naturales*. Where the form of the foreign body makes a perforation of stomach or bowel probable, operation may become more necessary.

The **danger** of gastrotomy in healthy tissue is exceedingly small, and therefore the operation, if necessary, ought to be strongly recommended.

Fistulæ of the Stomach.

Fistulæ, which have not been established purposely for operation, are **rare,** but may be the result of perforating wounds, or of ulcer or cancer of the stomach.

The **diagnosis** is certain if food particles are found in the fistulæ, and the chemical examination of this discharge shows the characteristics of the stomach secretion. The probe is not of much value.

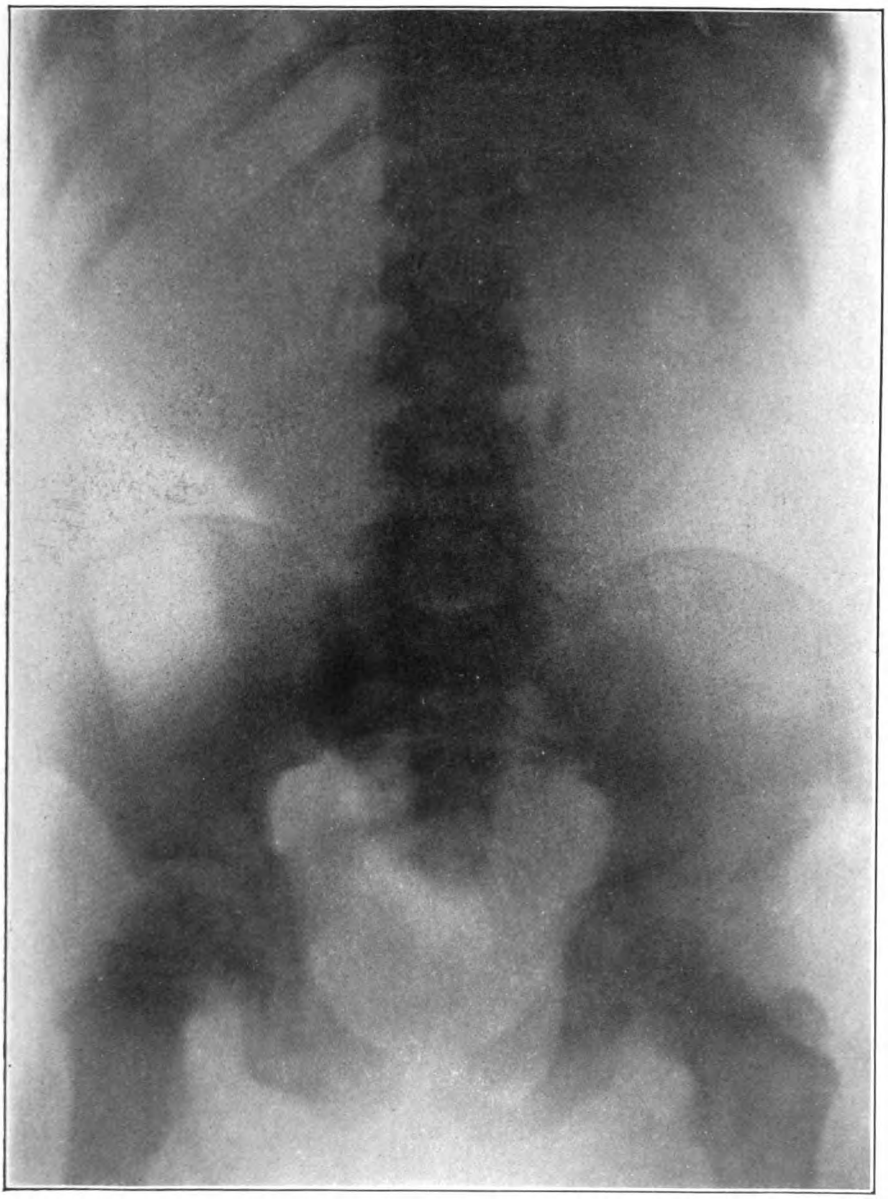
Small stomach fistulæ usually need no operation, as we see that even those made on purpose have a tendency to heal rapidly. Larger fistulæ have to be closed by operation.

DISEASES OF THE STOMACH.

Dilatation of the Stomach.

Due to two causes.

The dilatation may be due either to a purely atonic ectasia, or to an impediment caused by stenosis of the pylorus or its region. The former only rarely becomes the object of surgical interest; for the latter the most **important symptom** is the establishment of a tumor.



OLIVARY STOMACH BOUGIE.

The foreign body, partly in stomach, partly in duodenum, shows at the right of the spine between twelfth dorsal and third lumbar vertebræ. Removal by gastrotomy.

If dilatation of the stomach is improved, not only subjectively but also objectively, by proper treatment, especially lavage of the stomach, and if this improvement persists after the treatment has been stopped, the dilatation is probably due to **simple atony.** But if in spite of the constant washing out of the stomach, the wash-water again and again shows undigested masses, and if we find particles of food in the jejune stomach, in spite of rigid diet and regular washing, a **pylorus stenosis** is probable.

Pylorus stenosis may be due to processes from inside: Pylorus stenosis.

1st. Pylorus or duodenal carcinoma.

2d. Strictures resulting from ulcers.

3d. Hypertrophy of the pylorus, as the result of chronic gastritis and ulcers.

4th. Rotation of the filled stomach.

5th. Gall-stones.

From outside, stenosis may be due to:

1st. Tumors of the neighboring organs, as liver, gall-bladder, or pancreas.

2d. Strictural bands.

For comparison we put the symptoms of benign and malignant pylorus stenosis together as follows:

	Benign.	Malignant.
1. Duration	Years	Three to six months, at the utmost eighteen months.
2. Course	Free periods alternate with severe symptoms.	Growing intensity of symptoms, amelioration only passing.
3. Age	All ages after eighteen.	Usually after forty.
4. Tumor	Often lacking	Nearly always present.
5. Bloody vomiting	Light fresh blood (ulcer).	Coffee-ground vomitus, fresh hemorrhages possible after ulceration.
6. Œdema of the legs	None	Often present.
7. Metastasis	Absent	Present.
8. Contents of the Stomach:		
Odor		More foul than in benign.
Pepsin and rennet ferment	Present	Frequently absent.
Free HCl	Present	Present.
Lactic acid	Rare	Usually present.
9. Microscopical Examination:		
Sarcinæ	Present	Usually present.
Long filiform bacilli	Only few, if present at all.	Quantities.

Ulcer of the Stomach.

Ulcers of the stomach in well-developed cases present a complex of symptoms which assure a right diagnosis. Ulcer of the stomach is very
Age. frequent, it attacks twice as many women as men. The age is from fifteen to thirty, mostly about twenty, in men later.

The ulcers are nearly all situated near the **lesser curvature;** most on the **posterior wall,** only a very small number of ulcers are observed on the anterior wall, but if they occur there, they show the greatest tendency toward perforation. The patients complain of **dyspeptic symptoms** and feeling of pressure in the region of the stomach.

Pain. A very **important symptom** is the pain; it usually appears one-half to one hour after meals in **paroxysms.** It is usually due to mistakes in diet, to eating of very indigestible, very cold, or very hot food, or is caused by the irritation of a surplus of free acid; pressure usually increases the pain. The pain is always **located** to a certain spot of the stomach, either in the epigastrium, or at the spine between the shoulder-blades; its intensity is very frequently dependent upon the posture of the patient; for instance, it appears only if patients are lying on the right side (very **characteristic**). In **later stages,** if dilatation ensues due to cicatricial pylorus stenosis, or gastralgia caused by formation of scars, the **symptoms,** of course, become **different.**

Recurrence. The gastralgias caused by **scars** are extremely rare; on the contrary, the pain is usually absent if the ulcer has healed completely. If the pain, after apparent cure, appears again or is persistent, the ulcer is not healed completely, or there has been a recurrence.

Besides changes in the appetite, sour eructation, heartburn, and
Vomiting. nausea, **vomiting** is a constant sign. It occurs with the pain one-half to an hour after meals. The vomitus usually has a strongly acid reaction, owing to the excess of HCl (cf. below). In over fifty per cent of the cases the vomitus contains **blood,** which can usually be recognized as such. Only rarely, if the blood has been left a longer time in the stomach and has been converted into hæmatin, does it assume the coffee-ground character.

Sometimes there is some **difficulty in determining** if the hemorrhage really was from the stomach. If epistaxis occurs at night, a part of the blood flows back into the nasopharynx and, being swallowed, excites vomiting, so that a gastric hemorrhage is suggested. In hysterical cases bloody vomiting also occurs.

Difference between gastric and pulmonary hemorrhage.

The **differentiation** between gastric and pulmonary hemorrhage in doubtful cases depends on the following factors:

1st. The previous condition of the patient, whether he has had cough, expectoration, and other pulmonary symptoms, or gastric symptoms, pain and vomiting.

2d. On the character of the hemorrhage; whether accompanied by vomiting or cough, but there may have been both. Violent vomiting may excite a cough, and on the other hand blood, which has been coughed up, may be partly swallowed and produce vomiting.

3d. On the character of the evacuated blood; if from the lungs, it is usually bright red and frothy, containing air-bubbles, with few clots and of alkaline reaction. In gastric hemorrhage it is usually dark, mixed with food particles, partly clouded, and acid in reaction.

4th. On the character of the physical examination. This, of course, has to be carried out with extreme caution after hemorrhage, so as not to start fresh bleeding. Nevertheless, any pulmonary disease causing a severe hemorrhage is usually easy to demonstrate, while in diseases of the stomach we generally find nothing but signs of anæmia.

5th. On the subsequent symptoms. After a pulmonary hemorrhage the patients have, for a few days, expectoration of pure blood, or sputum with bloody streaks. After gastric hemorrhage, the next stool is liable to show black discoloration, owing to the presence of decomposed blood.

Hæmatemesis.*	**Hæmoptysis.***
1. Previous history points to gastric, hepatic, or splenic disease.	1. Cough or signs of some pulmonary or cardiac disease precede, in many cases, the hemorrhage.
2. The blood is brought up by vomiting, prior to which the patient may experience a feeling of giddiness or faintness.	2. The blood is coughed up, and is usually preceded by a sensation of tickling in the throat. If vomiting occurs, it follows the coughing.
3. The blood is usually clotted, mixed with particles of food, and has an acid reaction. It may be dark, grumous, and fluid.	3. The blood is frothy, bright red in color, alkaline in reaction. If clotted, rarely in such large coagula, and muco-pus may be mixed with it.

* After Osler.

Hæmatemesis.	Hæmoptysis.
4. Subsequent to the attack the patient passes tarry stools, and signs of disease of the abdominal viscera may be detected.	4. The cough persists, physical signs of local disease in the chest may usually be detected, and the sputa may be blood-stained for many days.

Fæces and urine do not show any special characteristics of value, except that the fæces become black, tar-like, after any copious hemorrhage of the stomach.

Hyperacidity, if present, is a symptom of great value; it is found in eighty per cent of all cases.

Motor disorders. Very frequently ulcers produce motor disorders, as stated above. They are due:

1st. To a narrowing of the exit of the stomach, and,

2d. To a diminution of the expulsive power of the muscles of the stomach (atony).

The **narrowing of the pylorus** may be produced by scar-stenosis, or it may be due to a spastic contraction of the muscular pylorus ring, especially during digestion, or to a sharp bend owing to adhesions. All these symptoms are usually present if the ulcer is near the pylorus; but even if farther away, it can excite pylorus spasm.

In quite a number of cases the **ulcer can be felt** as a tumor. Under favorable conditions (thin abdominal walls with good relaxation), the crater-like ulcer with the hard surrounding wall can be felt distinctly.

Ulcers of the anterior wall of the stomach, which, as said above, have the greatest tendency toward perforation, may become attached to the anterior wall, infiltrate the muscles, and so simulate a **tumor** of the wall of the stomach.

As a rule, though, it is rare that an ulcer is palpable, and if a tumor can be demonstrated it indicates more a malignant tumor than an ulcer.

Perforation. Perforation of the stomach may be entirely unexpected, and may be the **first symptom of ulcer** of the stomach, in which case the diagnosis may be very difficult. In other cases, where the ulcer has given sufficient symptoms to be diagnosed, the perforation is easy to recognize. It is always **characterized by severe pain,** followed by the symptoms of a localized or general peritonitis, according to the site of the ulcer, and to the existence or non-existence of preformed adhesions.

DIFFERENTIAL DIAGNOSIS.

	Ulcer.	Carcinoma.	Gastralgia (Unilateral Intercostal Neuralgia).	Cholelithiasis.	Duodenal Ulcer.
Acidity	Hyperacidity.	Usually free HCl absent or very much diminished.		No hyperacidity.	No hyperacidity.
Tumor	Very rare	Present			No tumor.
Age	Before forty.	After forty.			Twenty to forty.
Cachexia	None	Present			None.
Bloody vomitus	Pure blood	Coffee-ground masses.	Absent	Absent	Little; blood discharged into gut.
Perforation	Soon	Late			Possible.
Pain	Half an hour to one hour after meals, located at typical pressure points.	Unreliable	Attacks often long time between, without relation to meals.	Colic four to five hours after meals in the right hypochondrium, often radiating to right arm. After the attacks are over, complete absence of symptoms, often for a long time.	Located more to the right.
Gall-bladder	Not involved.			Increased size.	
Liver	Free			Edge near bladder swollen and tender to palpation.	
Icterus	None	Only if carcinoma has involved gall-bladder.		Usually present.	Rare.

As to the **exact site** of the ulcer, it is best not to enter into any diagnostic guessing, the more so as it does not influence a possible operation. If the pain is high up under the xiphoid process at the last act of deglutition, it points to a **cardia ulcer.** Any introduction of the **stomach-tube** for diagnostic purposes is to be **shunned,** as it might produce an abundant hemorrhage, which may bring patient and physician in a desperate position.

All **certain perforations** necessitate, of course, immediate operation as soon as the first shock, one to two hours, has been overcome. Operation.

A serious question is to be answered: should we recommend an

operation when the diagnosis of perforation is **uncertain?** Considering the very **bad prognosis of unoperated perforations** and the very remote danger of a properly executed exploratory laparotomy, we must urge operation even in cases which are not absolutely certain, the more so, as **eighty per cent** of the perforations **occur at the anterior wall,** which facilitates the finding of the perforation.

A second **indication** for operation **is hemorrhage,** either if it is acute, or so serious as to endanger life, and cannot be otherwise controlled, or if constant small hæmatemeses occur which lead to chronic anæmia.

A real or organic **stenosis of the pylorus,** not only a spastic condition of the same, producing grave motor insufficiency, indicates operation absolutely, in lighter cases only relatively.

The same is true of "**hour-glass**" **stomach.**

If the ulcer produces **adhesions** to the abdominal wall and neighboring organs of the stomach, with severe symptoms, gastrolysis, loosening of the adhesions, is proper.

All cases of ulcer, if they do not yield to proper medical treatment, and rob the patients of their enjoyment of life and capacity for work, may for those reasons become objects of operation.

Which of the many operations are best suited, we will not discuss here. It suffices to say that the percentage of **mortality** of stomach operations has come down to twelve to fifteen per cent.

Tumors of the Stomach.

Although other tumors than carcinoma occur, they are so rare that they may well be neglected here.

Benign tumors. Only the **myoma** is found among the benign tumors and is comparatively the most frequent. Its diagnosis is difficult, as it rests entirely on the presence of a tumor with no functional symptoms.

Carcinoma of the Stomach.

It is very frequent. Seven to eight per cent of **ulcers** of the stomach **lead to carcinoma.** The symptoms in the beginning are not very pronounced. Loss of appetite, eructation, coated tongue, feeling of pressure in the epigastrium, are indefinite symptoms.

Symptoms. Soon the **pain** becomes very marked, is localized frequently to the site of the affection, and assumes a paroxysmal character.

The **vomiting** is very marked if the carcinoma is near the pylorus (cf. below), and brings up particles of food, mucus, epithelia, bacteria,

and coffee-ground masses. Light blood is vomited only if erosion has taken place. Soon **cachexia** shows itself in sallow, yellowish complexion, loss of flesh, and slight œdema.

The most **positive sign is the tumor,** in fifty to sixty per cent at the pylorus, in ten per cent at the cardia. Sometimes the tumor can be seen, usually only felt; the latter in most cases not until the stomach is washed out. The tumor is hard, its surface is uneven, and sharply defined. The tumor, like all carcinomas, is **immovable** (of course, the tumor with the entire stomach can usually be moved, except in very far developed cases). The symptom that the tumor of the stomach does not move downward with inspiration is unreliable.

Free HCl is absent in most cases, but this is not pathognomonic. Chemical examination.

Lactic acid, if present in any quantity, is a very important symptom. If lactic acid is absent, carcinoma is improbable. In most cases there is a decided **motor hindrance,** so that we find after a time, when meals ought to be normally digested, large residua of food.

If particles of the tumor have been washed out or removed with the tube, which are recognized by the microscope as carcinoma, the **diagnosis** is, of course, absolutely certain. For differential diagnosis see the table above.

A pancreas carcinoma may be very easily mistaken for carcinoma of the stomach.

The tumors of the omentum and peritoneum may be extremely difficult to differentiate.

If all the other symptoms point toward a carcinoma, the diagnosis will be strengthened if these symptoms have developed in patients over forty who have been well until then, even if no tumor can be proven. On the other hand, my experience shows, that the **prognosis** of operations Operation. for cancer of the stomach, where a distinct tumor can be felt, is so bad that the effect is really only palliative, lasting usually not more than two to four months. That is, a cancer of the stomach, to give any good results, ought to be operated before a tumor can be felt.

Constant careful examination of stomach patients for HCl and lactic acid is therefore necessary and highly commendable.

In all cases where carcinoma of the stomach has been diagnosed, immediate operation is necessary, and in cases where the diagnosis is doubtful, a very small exploratory laparotomy, just enough to insert one finger, is strongly to be recommended, as connected with practically no danger.

INJURIES AND DISEASES OF THE INTESTINES.

EXAMINATION OF THE INTESTINES.

By inspection we learn the general configuration of the entire abdomen, as well as of its different parts.

Symptoms observed by inspection.

Uniform bulging of the abdomen is due either to meteorism or peritonitic exudation. **Irregular protuberances** may be due to inflation of a single loop or to fæcal tumors or to tumors of the gut, or peritoneum, or omentum.

The abdomen may be **drawn in,** indicating contraction of the abdominal muscles and certain spasmodic conditions, as in meningitis, lead-colic, carcinoma, etc.

Peristalsis may be seen through the abdominal walls. Sometimes it may be excited by slight tapping of the abdominal wall with the finger. This may indicate an obstruction to the passage of the contents of the intestines.

In examination for diseases of the intestines the **typical places for the hernias,** including epigastric hernia, should not be overlooked.

Palpation. The object of palpation is twofold, to find certain spots tender to pressure, or general tenderness of the abdomen, and to feel abnormal resistance and tumors.

Symptoms observed by palpation.

Palpation discloses sometimes a **gurgling sound,** called the ileocæcal gurgling, similar to the cooing of doves.

No abdominal palpation is complete without **examination per rectum,** and in women per vaginam. The introduction of the entire hand into the rectum has been abandoned, as unnecessarily dangerous.

In some cases **fluctuation** is to be felt. How to feel for the same, is described in the introductory chapter, page 10.

It is necessary to know the symptoms of **fæcal tumors.** They can be kneaded or moulded, like clay, by the pressure of the fingers.

Percussion. Percussion may reveal tympany or dulness, which may be of some value in certain diseases. Generally it is the least reliable

method of examination, and often misleading. Free or encapsulated fluid may be detected by it.

Exploratory puncture with aspiration, to show the eventual presence of pus, has been given up as too uncertain and too **dangerous.** Puncture of the gut very much distended by gas, with a very fine needle (of a hypodermic syringe), is more used for therapeutic than diagnostic purposes, but is connected with no danger. *Cave* exploratory puncture.

A very valuable diagnostic measure is **inflating the intestine** with air or water. The inflation usually reaches to the cæcum; the contours of the colon are made evident by it.

Inflation with air produces a high tympanitic sound; with water, dulness; both may be of value.

Filling the colon with air or water is best done by a soft-rubber rectal tube, or still better a **soft-rubber rectal bougie** of one of the smaller sizes. The latter are not longer than twelve inches, which is entirely sufficient. Rectal tubes need not be longer than fifteen inches. If they are too long they easily double up. Even high injections, if done with little pressure, can be given with short tubes. Inflation of colon.

The **injection with air** is done either by attaching an inverted siphon, which lets the carbonic acid gas escape, or with the rubber bulb.

The **injection of water** is done with a funnel and tube. One to two or three quarts of lukewarm water can thus be injected.

The insertion of the rectal tube is made with the patient lying on the side, but after that he lies on his back. The injection has to be made very slowly, and may take from a half to one hour.

INJURIES OF THE INTESTINES.

All the different forms of lesion described under the heading of stomach occur in the duodenum, small intestine, and colon.

Subcutaneous injuries more frequently produce perforations, as the duodenum may be pressed against the spine. Among the perforating subcutaneous injuries the total tearing off of the duodenum has to be mentioned.

The wounds of the duodenum with a wound of the abdominal wall, as by stabbing and shot, are similar to those of the stomach. In case of injury by the discharge of a shot-gun from some distance, we have to remember that a number of perforations may have taken place. The Wounds of the duodenum, etc.

symptoms are similar to those of injuries of the stomach, except that the pain is usually more localized toward the right; vomiting is rarer.

The same holds true with the **injuries of the small intestine.** The loops of the small intestine are arranged in the abdomen, so that one shot or cut may perforate a number of loops.

With the intestine the **mesentery may be injured,** which is of great importance, as the hemorrhages from its arteries have little tendency to stop, first, on account of the comparatively high pressure, and secondly, because the extravasation of fat in those injuries prevents ready coagulation.

Wounds of the colon.

The wounds of the colon show special characteristics only in so far as some colon wounds may be **extraperitoneal,** since a part of this bowel is not covered by peritoneum, and secondly, as the bacteria are more virulent, which makes the penetrating wounds of the colon decidedly more dangerous. On the other hand, the more solid contents prevent to some extent the escape of fæces into the peritoneal cavity.

The **omentum,** owing to its exposed site close to the abdominal wall, is very frequently injured.

DISEASES OF THE INTESTINES.

Intestinal Obstruction (Ileus).

Ileus is one of the most important surgical conditions of the intestines, producing a **complex of symptoms** composed of four principal characteristics, obstipation, pain, fæcal vomiting, and meteorism. It always presents a grave picture, and its early recognition is one of the most important duties of the physician.

Causes.

It is due either to a lack of motor power of the muscles of the gut (caused by paralysis) or to a mechanical obstacle occluding the intestine. A rare cause for **paralysis of the gut** may be an embolus in the mesenteric artery. Most frequently it is due to **peritonitis,** especially in its acute form, where the paralysis seems to be the result of the poisoning of the nerve centres by the products of bacterial infection. In chronic peritonitis other factors, as adhesions, etc., come into play.

The **obstacle** producing occlusion of the gut may be either in the **inside** of the intestines, as fæcal masses, gall-stones, foreign bodies, tumors, and scars of the intestines, or **outside,** as incarceration in inner or outer hernial rings, volvulus (twists and knots) of the intestines, or

intussusception or invagination, kinks by peritoneal adhesions, or compression by enlarged neighboring organs.

The symptoms of an intestinal occlusion may appear either suddenly or slowly, according to its course. Symptoms.

First, we have to decide if a **stenosis** of the gut exists. According to its degree, varying from slight hindrance to the evacuation of fæces up to the dangerous complex of symptoms of complete occlusion, the clinical picture varies greatly.

The first symptom is complete **obstipation** (the only exception occurs in invagination, where the impaction of the gut is indicated by violent, sometimes bloody, diarrhœa). The obstipation may be preceded by a longer or shorter period of constipation. The moment the occlusion occurs, the entire intestine will in most cases be filled more or less with fæces, therefore evacuation of fæces by injection or even in a natural passage (before complete paresis of the gut has resulted) is possible. The discharge is of the contents of the part of the gut below the obstruction, while the movement of the contents of the upper part is completely arrested. Therefore even the strongest laxatives do not induce any passages, but, on the contrary, increase the suffering and discomfort of the patient. Flatus can no longer be passed and therefore the intestine above the obstruction becomes distended, which very frequently shows as a visible tumor and gives a tympanitic resonance on percussion.

Frequent eructation, hiccough, singultus, and vomiting occur; at the same time we note shortness of breath, great anxiety, drawn face covered with cold sweat, cool extremities, small and frequent pulse. After some time **fæcal vomiting** sets in and collapse begins to appear. We may mention here that fæcal vomiting is not produced by antiperistalsis, but is simply the mechanical effect of stagnation to the point of overflow. The vomitus is first greenish-yellow, and becomes dark brown later on, and finally acquires a fæcal smell from decomposition. Other symptoms.

The **urine** shows, in cases of the dynamic ileus paralysis (by peritonitis, etc.) and in **obstruction of the small intestines,** an enormous increase of ten to fifteen fold of the normal quantity of indican, but not before the second day. Obstruction of the colon does not show this symptom.

It is sufficient to make the **diagnosis** of intestinal obstruction, without any effort to localize the same. Only three kinds have to be **differentiated,** namely, ileus caused by acute circumscribed or diffuse peritonitis, ileus by strangulation, and ileus by obturation.

Acute peritonitis, as stated above, always produces paralysis of a

Ileus due to peritonitis.

certain part of the intestine; the latter therefore becomes inflated by gas and its mobility is diminished.

The circumscribed and diffuse peritonitis differ only in the degree of paralysis and distention of the gut.

Symptoms.

The entire abdomen is generally tympanitic, barrel-shaped, no loops are visible or palpable, no gurgling sounds to be heard. The temperature may be very high, 104° or 105°, or more frequently between 100½° and 101½°, or even be more or less normal. Much more important is the condition of the pulse, which becomes rapid, 120 and above, and small.

If we find ileus as the result of peritonitis, our task is not done until we find the cause of this peritonitis.

If the anamnesis is in any way reliable, it can be of great help, and lead to the proper **diagnosis** of perforative peritonitis due to appendicitis, or ulcer of the stomach or gut. In all these cases, as well as in the other forms of ileus, early correct diagnosis is of the highest importance. As soon as a general peritonitis is well developed, the prognosis is exceedingly infaust.

Due to strangulation.

If we find a strangulation of a small loop, the proximal portion of intestine will be distended, either immediately or surely later on. But this loop is not paralyzed; on the contrary it shows distinct (even if only slight) erectility and peristaltic motions, either spontaneously or on tapping. This distention of the loop or the adducting gut can very frequently be felt by palpation, until peritonitis ensues, where complete paralysis of the intestine occurs.

Strangulation can be diagnosed just as in external hernia, if an individual, until then perfectly healthy, suddenly feels an intense pain, and is from that moment on seriously ill. Shock, and later on collapse, usually accompany the occurrence. A short while after, the other **symptoms of ileus** develop. Very soon nausea and vomiting of first greenish, later on feculent masses appear. As mentioned above, one or two passages may still occur, after which neither wind nor fæces can be expelled.

Examination of abdomen.

The examination of the abdomen has to be made **very carefully,** as it is exceedingly painful. It has to be given up entirely, where abnormal thickness or unusual rigidity of the abdominal walls is present. It is important to know that the **diagnosis must be made within the first forty-eight hours,** to be of any value to the patient. After that, on the third day, gangrene and infection are known to set in. In excep-

tional cases gangrene results within a remarkably short time, so that the diagnosis can hardly be made early enough.

One thing more: after the first violent symptoms are over, paralysis begins. There is in a number of cases a remarkable **euphoria,** which must not mislead the physician. The patients are slightly apathetic and answer questions as to how they feel, a little hesitatingly perhaps, but with the assertion that they are all right. After a short interval peritonitis sets in, with its usual restlessness and alarming symptoms. One thing might still be mentioned, that is, the **facies peritonealis,** which I have described in the introductory part. There is a peculiar anxious expression in the face of those patients who have abdominal or peritoneal shock. The tip of the nose is pale, dry, and sunken-in, frequently the alæ of the nose are working during respiration. The tongue is dry, cracked, and red, later on brown.

The **clinical picture,** which it is sometimes necessary to observe for twenty-four hours or so, is decidedly **disturbed,** if the physician begins to wash out the stomach and gives opiates before a diagnosis is made; these measures cannot influence the strangulation and they rob us of the possibility of observing correctly.

Ileus due to obturation.

If the intestines become obturated by chronic stenosis of the gut, which finally leads to complete occlusion, or by foreign bodies, as large gall-stones, which finally become wedged (both producing the same effect), the symptoms must naturally be **less violent.** Therefore those cases lack the very intense pain at the start, and the symptoms of collapse; they present clearly recognizable inflated loops, with more or less pronounced peristalsis, and we usually get a history of a causative abdominal disease before the ileus sets in.

Invagination can often be diagnosed with certainty; it frequently occurs in children who, perfectly well until then, suddenly, after a violent fit of pain, have nausea, vomiting, tenesmus, and bloody stools, after that obstipation and meteorism. Palpation shows the roller-like stiff cylinder of invagination.

Indication for operation.

The question, which cases of invagination ought to be operated upon, is not very easy to decide. Sometimes injection of water or air, if the intussusception is high, may be of value, or, if it is lower down, attempts at mechanical reposition by flexible sounds armed with sponges are decidedly permissible if carried out carefully. If these manipulations do not show the desired effect, operation ought not to be deferred too long. The third day seems to be critical in these cases too.

Appendicitis.

Inflammation of the vermiform appendix is at once the most common and the most important of acute intestinal disorders. The reason for this exceptional standing of inflammation of the appendix in general pathology is due to its anatomy.

Peculiar nature of appendix.

The appendix is a relic **without function** of a large ancestral cæcum. It is a blind sac of **small dimensions,** from one to three inches in length, and about one-quarter of an inch wide. The fact of this small size enables us to understand why comparatively slight changes, which would be hardly noticed in a normal organ of larger dimensions, especially in one which possesses afflux and efflux, may produce serious results. Simple injection of the mucous membrane (hyperæmia) may produce enough swelling to render its own blood-supply difficult. In fact, in a number of the many cases I have operated upon, I could prove to my own satisfaction that the swelling, originally introduced by some slight bacterial infection, sufficed to compress the vessels (lymphatic and otherwise) and to induce gangrene by self-strangulation.

The second important point is the fact that the **appendix is a blind sac,** even if there is no stricture (as so very frequently occurs). Any removal of contents, which have become stagnated, is extremely unlikely. There is no drainage and no lavage, at least as soon as normal conditions are disturbed. The examination of a great many apparently normal appendices during other operations have rarely shown the appendix filled with fluid fæces. In most cases it seems to be empty.

The third point of importance is the presence of **foreign bodies in the appendix.** Foreign bodies in the common sense are extremely rare. In four hundred of my cases, which I have looked through, a foreign body was found twice, but in neither case did it lead to perforation.

But foreign bodies in the wider sense are very frequent, viz., **fæcal stones.** The presence of old, hard, dried-up fæcal stones in many cases of acute perforative appendicitis, proves that these foreign bodies by themselves did not lead to perforation or even to appendicitis, or they would have done so as soon as formed, while their very appearance and hard consistency shows that they are, in many cases at least, quite old.

Appendicitis due to bacterial infection.

Therefore an inflammation aside from that one due to irritation of the foreign body, must be responsible, and that **inflammation is due to bacterial infection,** in most cases doubtless that of bacterium coli.

I have made these few preliminary remarks to give an etiological

explanation for the manifold and often surprising conditions to be found in appendicitis, and to rob it of its halo of mystery. It is just this uncertainty, and the unexpected that so frequently happens in appendicitis, which make this disease the terror alike of patients and of the physicians with whom the responsibility of the diagnosis rests.

Pain the first symptom.

Acute appendicitis in nearly all cases starts in with severe, violent, sharp, abdominal pain, very frequently experienced suddenly during defecation; this occurs after the patients have been until then entirely well, possibly a slight abdominal disorder preceding. The **sharp initial pain** is something entirely different from the violent pain, frequently followed by collapse, which in badly observed cases seems also to be the beginning of the disease, but is in reality the moment of perforation. Cf. below. The character of the pain is sometimes described by intelligent patients, and especially by physicians who became appendicitis patients, as similar to that of internal incarceration.

Location of pain.

This pain usually lasts only for a couple of hours, after which it subsides, or at least greatly diminishes. The **pain** is frequently **located in the right iliac fossa,** but is experienced quite as frequently just below the navel in the mesial line. The pain then usually becomes more diffuse, to concentrate after six to twelve hours again in the typical region. **Nausea** frequently accompanies the pain, followed in some cases by vomiting. There is usually a slight **rise of temperature** to about 102°, although in children the temperature may be as high as 103½°. The **pulse** is generally influenced at once, and becomes, at least at times, high, about 100.

If we examine a case of appendicitis in this stage, we find, nearly without exception, the **right rectus contracted** and, about an inch and a half below the umbilicus, **tender on pressure.** This symptom is sometimes marked where the so-called local tenderness is not very pronounced.

The question of **tumor to be felt is very important.** Under favorable conditions, in patients not too fat and intestines not too much filled, the normal appendix can doubtless be felt by experienced hands. Under the same conditions even a slight increase in the volume of the appendix or in its resistance (by swelling or tense fulness) cannot escape the examiner.

What is usually spoken of as a palpable tumor consists of the **swollen appendix,** with its injected mesenteriolum and œdema surrounding it. This tumor, described just now, is usually not larger than the little finger

or at most the thumb. The large tumors due to appendicitis abscess are described under that heading.

Gentle (!) percussion discloses dulness in the appendix region.

Examination per rectum.

Examination per rectum, which ought never to be neglected in an apparent case of appendicitis, is in many cases of great value. If the appendix is in its normal position, usually some part of it can be felt per rectum, either enlarged or tender on pressure.

Condition of the tongue.

The **tongue** is of great importance in the different forms and stages of the disease. Even in comparatively mild attacks of appendicitis, the tongue is hardly ever normal. In pronounced cases the tongue is dry, cracked, often brown, and its appearance is entirely out of proportion with the temperature or the abdominal symptoms. In cases still further developed, especially those of gangrene of the appendix and peritonitis, the patient's breath is frequently sweetish, and according to the general septic infection, acetone-like.

Diagnosis.

If the above-named symptoms, sudden pain in the right iliac fossa, localized tenderness, increased temperature and pulse, as described above, are present, with or without tumor, the diagnosis of appendicitis is certain in plain uncomplicated cases. This does not necessarily mean that an operation under all circumstances is necessary, but it means that we have to deal with a **surgical disease.** First, there is no internal treatment for appendicitis, and, secondly, we have to be prepared for unexpected changes, which may necessitate immediate operation.

The responsibility of the physician observing a case of appendicitis is so great, because it is impossible to tell what its further course will be. We must remember that a surgeon is often called too late, never too early.

Indication for operation.

The question of indication for operation is, for the very same reason, equally difficult to answer. If the patient is in a hospital, where an operation can be performed at once if necessary, and under good observation, we can afford, in a number of cases, to wait for developments, and can doubtless sometimes let the attack pass without operating; we may thus be able to postpone the question of an eventual operation until later (interval operation), which is surely connected with less danger.

It is entirely a question of personal experience in getting the right clinical impression of each case, to enable us to decide whether to wait and observe, or to operate at once. But this experience can be gained only by carefully noting a large number of clinical facts, and comparing

our diagnosis and prognosis of each case with the autopsy *in vivo, i.e.*, the actual conditions found during operation.

In a great many cases one is surprised to find how dangerously far the disease has developed, especially how near the appendix sometimes is to perforation, with such comparatively slight clinical symptoms as to make it impossible to anticipate these conditions; hence the great responsibility, the great uncertainty. The situation is therefore thus: we have to deal with the acute disease of a useless organ, a disease which may at any time become extremely dangerous by perforation; even if that does not take place, the result of the inflammation will be, either that the patient never fully recovers but remains an invalid, suffering constant slight pain, constant intestinal disorder, or it will result in such anatomical changes (strictures, complete occlusion, presence of fæcal stones, peritoneal adhesions) that the first attack is more likely to be followed by one or more of the same kind, of which we are unable to predict what the character and virulence will be.

Further course of appendicitis.

Under these circumstances it should not be difficult to come to the conclusion to operate upon all cases of well-developed acute appendicitis, except where such cases, well observed in hospital surroundings, show absolutely no alarming symptoms, so that we can afford to postpone the operation until the acute attack has passed.

In describing the further stages of appendicitis, any one of which we may have to deal with in our diagnosis, we first have to mention perforation. Perforation is doubtless most frequently due to the **presence of a fæcal stone.** Another frequent cause is **gangrene of the appendix,** due to a septic thrombosis of the vessels. If gangrene is produced by an acute septic infection, the general system usually shows symptoms of sepsis before operation. In these cases patients show well-defined abdominal shock and a general septic condition; the latter, as is well known, is rarely accompanied by high temperatures; on the contrary, temperatures from 101° to 102° are the rule, but the pulse is exceedingly high, above 120.

Perforation.

The immediate result of the perforation depends upon whether or not there has been time and occasion for **adhesions** to form. This greatly depends upon the situation of the appendix, if the latter is bent a great deal (either by a mesenteriolum or by kinks produced by stricture). If the appendix becomes attached behind the colon, so that the head of the colon is lying on top of it, adhesions are most frequent. If adhesions for any reason have formed, the perforation of the appendix produces **ap-**

Result of perforation.

pendicular abscess, which can be felt distinctly by palpation in all but exceptional cases. To find this abscess, we have to remember that in a great many cases the **appendix is not in its normal place,** but may be found, for instance, under the liver, or in the small pelvis, or in an inguinal hernia, or (if the colon is unusually movable and the appendix very long) on the left side.

Symptoms of perforation.

The clinical symptoms of perforation of the appendix and the formation of a circumscribed abscess may be very misleading. Frequently there is little shock connected with it, though usually a short, very severe pain occurs, after which the patients feel a great deal relieved, and seem to be generally improved. The pulse, very rapid before, goes down to a hundred or so; the temperature does not indicate anything, it may vary between 99½° and 101°; this is especially the case if no resorption takes place from this abscess. The patients now feel so well, in many cases, that the entire cause of the disease up to that point may have been overlooked, and the patients consider themselves well until a **second perforation** of this abscess into the general peritoneal cavity takes place. This is a condition we find quite frequently; the patients, especially children, claim to have been entirely well, slight intestinal disorder excepted, till suddenly a furious pain, with a feeling that something gave way, sets in, followed by a most severe clinical picture of general peritonitis; those patients have gone through the entire appendicitis attack in an ambulant way, as in "walking typhoid," and are apparently smitten with violent septic peritonitis as the first symptom.

Ambulant appendicitis.

We have one quite important diagnostic expedient in **hyperleucocytosis,** at least in so far that we can say that a count of more than 20,000 leucocytes to the c.c. of blood indicates an abscess; but the opposite of this does not hold true, *i.e.*, the absence of such a high leucocytosis affords no proof that there is no abscess.

Aspiration or **exploratory puncture** has been recommended to substantiate the diagnosis of abscess; I **warn very strongly against it.** Either the abscess is big enough to permit a diagnosis without puncture, or it is small, and will then most probably be missed by the needle, so that in no case will the procedure be of value, and in any case it will be dangerous, by carrying on the infection.

I want to repeat that I consider it of the highest importance to be able to understand this clinical picture just outlined, because a great number of appendicitis abscesses have a tendency to burst and infect the general peritoneal cavity. It is needless to say that as soon as the diag-

nosis is made, immediate operation, after very careful examination and, if it is necessary, extremely careful transportation, should be resorted to. It would be little short of criminal to expect the abscess to become absorbed, or to perforate *per vias naturales* into an organ like the intestine, rectum, bladder, etc., where it can be evacuated without harm. Operation.

If **no adhesions** have formed previous to the **perforation,** the latter at once **infects the entire abdomen,** while its virulence depends in a certain degree upon that of the septic material contained in the abscess. **General peritonitis,** due to perforative appendicitis, is **always most grave,** and, in by far the most cases, fatal. Nevertheless, as soon as this condition has been recognized, **immediate operation** (the difference of one or two hours may mean life or death) is to be advised, as it cannot be denied that in quite a number of desperate cases mechanical washing out of the abdominal cavity, with large quantities of salt solution and drainage afterward, has saved a number of those cases.

If the appendix becomes attached to the iliac fossa or to the wall of the pelvis, the adhesions may take place in such a way that the **perforations occur into the retroperitoneal tissue.** Such an abscess gives very few symptoms and may become quite large before being detected, unless the examination is made very carefully. Frequently these abscesses can be better felt from the lumbar region than from the abdomen.

Another form of the collection of pus is to be mentioned, viz., empyema of the appendix. If the original inflammation of the mucous membrane of the appendix is one which leads to the formation of copious pus, before the walls are considerably weakened, we find an unusually large appendix (as long and as thick as an index finger, sometimes as big as a thumb) filled with creamy pus. The **symptoms** of the empyema correspond exactly to those of a circumscribed abscess. Empyema of the appendix.

The abscess frequently, after a short while, **increases quickly** and thus can be diagnosed by the **resistance and dulness** (except in those rare cases where gas forms in the pus; then we will find tympany).

In many cases the enlarged abscess becomes **adherent to the front wall** of the abdomen, **infiltration** of the peritoneum, fascia, muscles, and finally of the subcutaneous tissue and the skin itself takes place, so that we find œdema, reddening of the skin, and superficial fluctuation.

For more than a year I have paid special attention to the **disorders of sensibility of the skin** in visceral diseases (following Head), but I have come to the conclusion that this system is not yet well enough established to be of universal use to the general practitioner in his diag-

nosis. Misconceptions and wrong conclusions occur too easily, so that this method is not as yet of any practical value.

Recurrence.

Recurrence is of **great importance** in appendicitis. This is a point which we have to consider in the **anamnesis,** where we are to find out if we have to deal with the first attack or a later one. The result of even a slight attack of appendicitis may lead to **anatomical changes** of the appendix (strictures, fæcal stones, kinks, ulcers), which are bound to give rise to further attacks. We are unable to foretell the character of the subsequent inflammations; frequently we observe that after a very slight first attack, an unusually severe, sometimes fatal, second one ensues; but not only that, sometimes the patients never fully recover from their first attack, and become chronic invalids until the cause of the disease, the chronically inflamed appendix, is removed.

Chronic appendicitis.

In some cases it is not only the condition of the appendix which incapacitates the patients, but the existence of adhesions formed during the acute attack. These **adhesions** are not only of importance, as they give rise to constant discomfort, frequently slight peritoneal shock by tension, digestive disorders, etc., but they may become a great danger by inducing ileus. (Cf. the section on this subject.)

Typhoid ulcer of appendix.

A **rare affection** of the appendix should be noted, as it is important, in spite of its being an unusual occurrence, viz., the typhoid ulcer of the appendix. I have operated now in two cases with the following **clinical picture:**

The patient had an acute attack of appendicitis, localized pain, tenderness, abdominal shock, vomiting, temperature going up within twenty-four hours to 104½°, pulse to 120. Extirpation of the appendix showed a beginning **typhoid ulcer** in the appendix with typhoid bacilli. Later on, general, well-marked typhoid fever followed, with recovery. I am under the impression that in both cases the typhoid ulcer would have perforated, but for the operation.

Tuberculosis and actinomycosis.

Two other affections of the appendix are so **rare** that it suffices to mention them, viz., tuberculosis and actinomycosis. They are both characterized by extremely slow development of the respective disease, and their course is that of a chronic appendicitis, which may reach a more acute stage in its later development.

Other Ulcerative Diseases of the Intestines.

There are a number of different forms of ulcer of the intestines, as peptic ulcers, of which the duodenal ulcer is the prototype, embolic ulcers, ulcers occurring with multiple neuritis, and amyloid ulcers; also, tuberculous, dysenteric, and syphilitic ulcers, besides infectious ulcers, as in typhoid and anthrax.

All **ulcers of the intestinal tract** have this in common, that it is practically impossible to make a precise diagnosis. Mostly they occur **without any significant symptoms** and indications, like diarrhœa. Pain, blood, and pus in the stools prove of very little value for the diagnosis. Diarrhœa is practically without any value as a symptom. Of a little more importance is **blood,** but it **may be due, besides an ulcer,** to trauma, stasis, hæmorrhoids, enteritis, neoplasms, embolus of the mesenteric artery, purpura, and other systemic diseases. Therefore bloody stools are of value only when other symptoms indicate a lesion of the intestine, which frequently leads to ulceration. The absence of blood in the stools, of course, must never be allowed to speak against ulcer.

Bloody stools.

Pus can be expected only if the **ulcers** are **in the colon,** especially in its lower part, but as ulcerations are much more frequent in the small intestine where pus is washed away very quickly, the absence of pus in the stools does not exclude an ulcerative process in the intestine; but even if positive, the presence of pus loses much of its significance, as it practically is always present in the later stages of carcinoma of the intestines.

Pus in stools.

The presence of **mucus** is without any diagnostic value; but if little **lumps of mucus** appear, resembling sago, it may indicate ulceration of the follicles.

Of more value are **shreds of tissue,** but unfortunately they occur very rarely, except in dysentery.

The **pain** is of some value only if it is constantly **localized** to the same spot, but its absence must never be used against ulcer.

The duodenal ulcer frequently has a course so similar to that of gastric ulcer, that it is impossible to differentiate them. Nevertheless the former gives dyspeptic symptoms, pressure or severe **pain in the epigastrium** (usually situated to the right of the pylorus) mostly increased after meals and by outside pressure. Besides this there is vomiting of blood, though it is usually evacuated in the form of thin black stools. Icterus indicates duodenal ulcer. The hyperacidity, usually

Duodenal ulcer (cf. table, p. 171).

present in gastric ulcer (which see) usually is absent in the duodenal ulcer.

Tuberculosis. **Tuberculous ulcers** are usually only a **symptom** of otherwise well-developed tuberculosis, as they are mostly secondary. **Primary intestinal tuberculosis** is probable, if we find constant high fever, pronounced cachexia, hereditary disposition, and, a most important symptom, numerous tubercle bacilli in the stools. In **secondary tuberculosis** we must not forget that tubercle bacilli are frequently swallowed and may therefore appear in the stools.

Dysenteric stools show, besides mucin, a strikingly high percentage of albumin and leucocytes, red blood-corpuscles, intestinal epithelia, shreds of tissue, and countless bacteria, especially amœbæ. Dysentery usually occurs in epidemics.

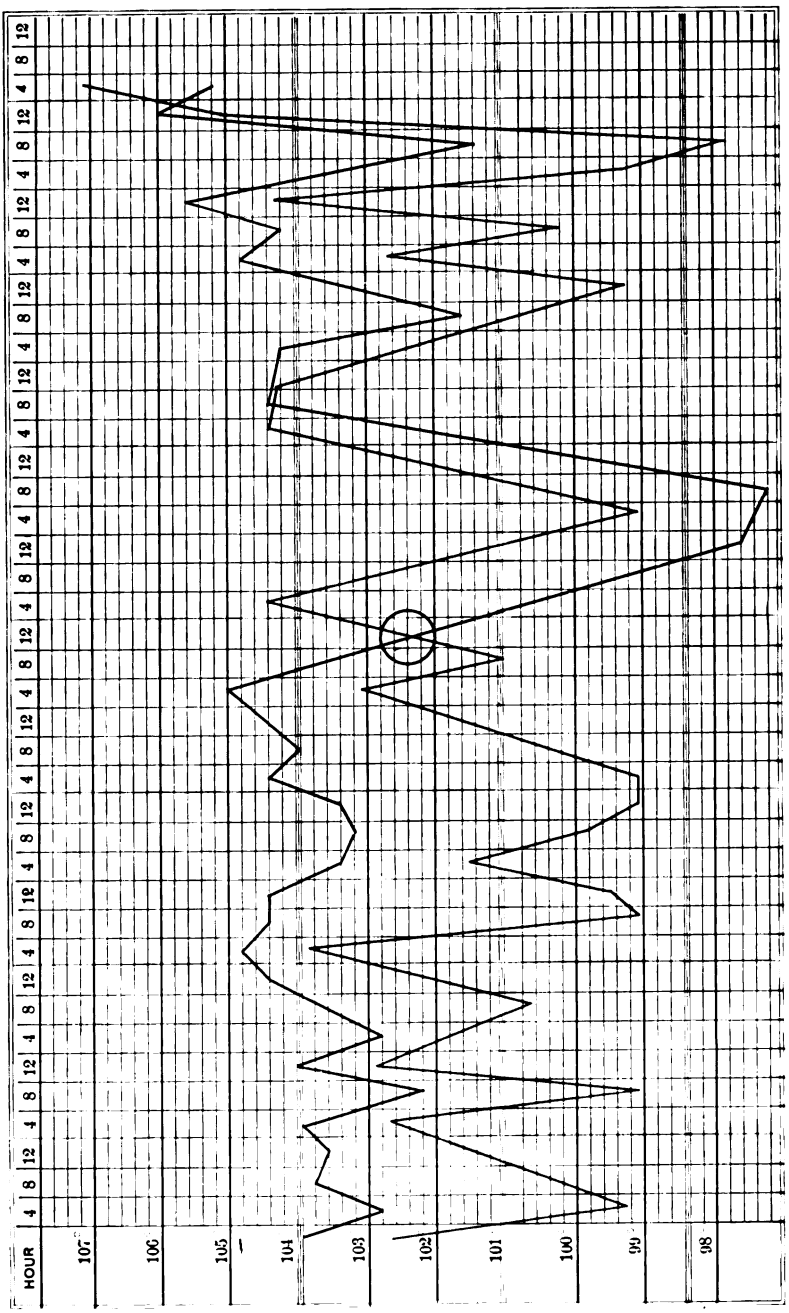
Syphilis. **Syphilis** is of interest and recognizable only if it has its seat in the **rectum,** where the ulcers, combined with gummatous neoplasms, with characteristic undermined edges, can be seen by the rectoscope and felt by the examining finger. It is most frequent in women.

The differential diagnosis between tuberculosis, syphilis, and gonorrhœa is exceedingly difficult, sometimes impossible. They are all characterized by ulcers, a very slow course of the disease, very little tendency toward healing of the ulcers, and frequent recurrences. If pathognomonic bacteria (tubercle bacilli or gonococci) can be found, the diagnosis is decided.

Anthrax is so rare that it must suffice to say that it is probable if, besides bloody diarrhœa, black suggillations are found in the mucous membrane of the mouth.

Typhoid ulcer. Typhoid ulcers become of interest to the surgeon only if **perforation** takes place, which is the case in about three to five per cent of typhoid, according to the virulence of the epidemic. Half of these perforations occur in the third and fourth weeks, though they are possible in the first week, and have been observed as late as the sixteenth. They are usually the result of severe forms.

The **symptoms** which interest us are those of the perforation itself. By far the most important symptom of the perforation is **sudden, sharp, paroxysmal pain** of increasing severity; it is rarely absent except in cases of coma. It is most frequent in the hypogastric region; sometimes only localized tenderness on deep pressure exists. There may be early muscular rigidity, and increased tension and spasm on any attempt to palpate. In a number of cases, with the pain of perforation the patient



CROSSING OF CURVES IN PERFORATION OF TYPHOID ULCER.
Circle indicates crossing, when temperature falls rapidly, and pulse rises.

shows **signs of shock** with a surprising drop of temperature, increase in the rapidity of the pulse, and a tendency to sweat. The two former produce the much dreaded **crossing of the curves** of temperature and pulse. The sudden drop of temperature cannot be overlooked and calls for the closest attention. The **diagnosis of perforation** is of value only if made at once, and if the operation to be performed is carried out during the first twelve hours. With each consecutive hour the prognosis becomes worse.

Severe intestinal hemorrhage may produce similar symptoms.

Tumors of the Intestines.

A number of **benign** tumors of the intestines are possible, but extremely **rare.** They belong to the group of adenoma, lipoma, fibroma, myoma, etc., and are hardly ever diagnosed during life, as they give **very few symptoms,** except possibly stenosis. If they become recognizable by growing into the lumen of the intestine, extirpation is indicated.

Sarcoma.

Of more importance are sarcoma and carcinoma, of which the former is rare. It occurs most frequently between the thirtieth and fortieth year, and the **symptoms** which make the diagnosis possible are an **extremely movable tumor** with frequently but slight stenosis. The course is exceedingly rapid, still more so than in carcinoma. Soon ascites, metastasis, and cachexia set in. The diagnosis can be made at best with probability, hardly ever with any positiveness.

Carcinoma.

The carcinoma of the intestines is by far more frequent, especially that of the colon and still more so that of the rectum.

The intestinal cancer attacks men and women equally, only the rectal cancer seems to be more frequent with men. It occurs most frequently between forty and sixty.

Carcinoma recti (cf. p. 209).

The carcinoma recti is by far the easiest to recognize. A simple **digital examination** usually suffices, as it hardly ever is situated so high that it cannot be reached with a finger. In the early stages one feels **small, hard nodules** in the wall of the rectum, over which the mucous membrane is not distinctly movable. Later on, the rectal lumen is transformed into a longer or shorter **hard cylinder of stiff walls.** If the tumor is ulcerated, blood and discharge are found. **Hæmorrhoids** are hardly ever absent, which should induce the physician to examine every case of hæmorrhoids for carcinoma. If a tumor in the rectum is found,

we can assume in ninety-nine cases out of a hundred that it is cancer. **Polyps,** of course, have to be excluded. If there should be any doubt as to the nature of the tumor, a small but deep excision for **microscopical examination** will decide this question. Carcinoma of the other parts of the intestine is much more difficult to diagnose.

Differential diagnosis.

The differential diagnosis has to consider, eventually to exclude, carcinoma of the stomach, corset liver (which can easily be made out by the contours of the free edge of the liver), movable kidney, and movable spleen, which latter ought to be recognized from their characteristic forms.

More difficult is the differentiation from scybala, **fæcal tumors.** Mistakes are made the more easily as intestinal cancer is accompanied by obstipation and accumulation of fæcal masses. If the masses are old and hard, they feel exactly like carcinoma, but even hardened **fæcal masses can be pressed flat** by the palpating finger.

Kidney tumors and tumors of the **mesenteric glands** develop behind the gut and appear on the abdominal surface only if they have assumed very large size. Stenosis is always absent in kidney tumors.

Peritoneal exudations, especially those resulting from appendicitis, may give an impression very similar to carcinoma, and sometimes the diagnosis is not possible without exploratory laparotomy.

DISEASES OF THE MESENTERY AND OMENTUM.

Thrombosis.

By far the most important disease is **thrombosis of the mesenteric arteries,** although its occurrence is comparatively **rare.** It is necessary to know the **clinical picture** in order to recognize it. It results either in intestinal hemorrhage and diarrhœa, or in ileus. The **hemorrhage** is produced by extravasation of blood in the mucous membrane, and sudden **profuse bloody movements,** sometimes consisting only of blood, appear. In other cases, though apparently rarer, the arrest of the blood supply produces paralysis and, later on, gangrene of the loop affected. The **paralytic ileus** prevents any diarrhœa, and vomiting, frequently bloody, sets in instead. Early diagnosis is exceedingly difficult, and the **prognosis is absolutely fatal.** All patients operated upon so far have died.

The mesentery and omentum may develop **cysts** and **tumors.**

Lipomas are most frequent. They may reach immense size and weight, and are then easily recognized. The operation, as all operations on the mesentery and omentum, is not without grave danger.

CONGENITAL ANOMALIES OF THE INTESTINES.

By far the most frequent congenital anomaly of the intestine is **Meckel's diverticulum.** It is the remains of the omphalomesenteric (vitello-intestinal) duct and persists as a blind appendix-like attachment of the lower ileum. It is usually situated about twenty to twenty-three inches above the ileocæcal valve. Its width varies from half an inch to an inch and a half and more, and its length from one inch to twelve inches. Its distal end is either free or attached to the umbilicus by the obliterated omphalomesenteric duct. Like the vermiform appendix Meckel's diverticulum becomes of **importance only by pathological complications.** It may get into a hernial sac and create the symptoms of Littre's hernia, or, which is more important, it can either encircle a loop of the gut or strangulate loops by its stringy attachment to the navel. Much rarer are foreign bodies in the diverticulum or an acute inflammation similar to appendicitis.

Meckel's diverticulum.

This anomaly is not at all rare (two per cent) and must therefore be taken into consideration.

The atresia of the intestine is rare, except at the anus and rectum (see below).

Foreign Bodies.

Aside from foreign bodies entering from outside, they may reach the intestine from the stomach. We also find in the bowel gall-stones, and even vesical and renal calculi. Finally the gut itself produces foreign bodies, viz., **enteroliths,** real concrements consisting of phosphate of lime and magnesia, frequently with a foreign body as a kernel, then coproliths or **fæcal stones,** which may reach enormous size and hardness, finally **fæcal tumors,** consisting of fæcal masses which still can be moulded by impressions of the finger.

Fæcal stones and tumors.

The presence of a foreign body gives absolutely **no symptoms** until the foreign body becomes arrested; then it may be recognizable by the symptoms, either as a palpable tumor or through its producing partial or complete occlusion.

Anamnestic data will be of the greatest value. The diagnosis is important, as it is necessary to recommend operation before a possible perforation sets in.

DISEASES OF THE RECTUM AND ANUS.

The diseases of the rectum are manifold and frequent. They are more overlooked than diseases of any other organ, for which the patients as well as some physicians are responsible.

Local examination.

The patients, either from ignorance or disliking the idea of a local examination too much, do not seek professional aid. A great many physicians, on the other hand, neglect a local examination, by palpation or inspection, for obvious reasons. Since the introduction of rubber cots for the examining finger this objection can surely not hold good any more. Besides this, in a great many cases the indication for a local examination must be gained from the history of the case, and the diagnosis of a suspected rectum disease must be made, to necessitate local examination. The examination is made by inspection and palpation.

The **position of the patient** for this examination is of importance. The simplest method is to let the patient stand with his back to the window and bend over sharply, resting the hands on the seat of a chair. More convenient and more efficient are, according to the different cases,

Positions for examination.

Sims' posture (left lateral posture), an exaggerated lithotomy position, and the knee-chest posture. The latter position is very frequently assumed incorrectly by the patients. We have to see that the thighs are perpendicular, the sacrum the highest point, and the head way down on the examining table, on which the patient kneels. A special table for rectum examination has been constructed by Martin. Usually Sims' position is most convenient and sufficient.

In a number of cases it is important that the digital examination be carried out in a **standing position** also, so that the pelvic organs come down toward the examining finger by their weight.

In any of these positions **simple inspection of the anus** can show a great deal. We can observe condylomata, fibroids, polyps, hemorrhoids, and their special condition can be seen. The **cutis** as well as the mucous membrane, as far as it can be seen without the introduction of instruments, should be carefully inspected. Fissures, fistulæ, any discharge, etc., can thus be noted.

Digital examination.

The simple inspection should always be followed by digital examination. We can reach as high as four inches with the finger. Possibly if the patient presses and the other hand brings the rectum down, four and a half inches can be reached, but not more.

The examination with the finger is to be carried out in the following manner:

The finger is covered with a cot, and some vaseline or lubricant put on it out of a sterilized collapsible tube (*cave* the old vaseline pot or oil jar).

The introduction of the finger is to be done very carefully and slowly, to overcome the action of the sphincter, as well as to avoid unnecessary pain. The introduced finger feels the condition of the **mucous membrane,** especially the possible presence of **hemorrhoids** with or without thrombi, the internal opening of a **fistula,** fluctuation of a **perirectal abscess,** and the presence of small foreign bodies, which have lodged in the crypts or have been caught in the grasp of the muscles.

What may be felt.

Not infrequently large **foreign bodies**, especially in children, can be found in the ampulla, where they are retained after having passed the entire intestinal tract.

As I have mentioned under another heading, examination of the rectum with the entire hand under narcosis has been abandoned as too dangerous.

If the finger is withdrawn and the patient is requested to bear down, internal hemorrhoids, if present, will frequently follow it out through the anus. If there is blood, mucus, or pus in the rectum, it will also follow the withdrawal of the finger.

The **odor** is also important. That imparted by carcinoma in the rectum can never be forgotten after one experience.

Instruments.

For **inspecting with instruments,** Kelly's set for examining the rectum and sigmoid has made all other instruments practically superfluous.

For anybody who has to do a great deal of rectal diagnosis, the pneumatic proctoscope, carrying an electric light, is to be recommended.

For **bougies,** to determine the permeability of the rectum or the presence of strictures, the soft-rubber rectal bougie and the rectal bougie *à boule* (a flexible bougie of hard rubber, with different-sized olives to be screwed on) are used.

General anæsthesia is very rarely necessary for examination. If the

examination is carried out properly, in the proper position and with the necessary care, the pain is usually very little.

I have to **warn against the use of cocaine.** If applied externally it usually is without effect, and the quick absorption which takes place from the rectum makes its internal use exceedingly dangerous.

The examination of the **fæces** is in some cases quite important. It may be carried out by macroscopical, microscopical, bacteriological, and chemical methods.

For surgical diagnosis, blood, pus, mucus, and shreds of tissue are of importance.

Congenital Malformations of the Anus and Rectum.

The malformations of the **anus** are:

1st. Entire absence of the anus.
2d. Abnormal narrowing of the anus.
3d. Partial occlusion.
4th. Absolute occlusion.
5th. Anal opening at some abnormal point.

The malformations of the **rectum** are:

1st. Rectum entirely absent.
2d. The rectum ends at some distance from the anus, which is normal.
3d. The rectum opens into some other organ, anus present or absent.
4th. Rectum and anus normal, but ureter, bladder, vagina, urethra, or uterus opens into it.

All these conditions, malformations of the anus as well as the rectum, are easily recognized as soon as the child is born.

If the deformity is only partial, it is frequently overlooked, but close examination ought to reveal it at once. Besides the local aspect, the
Occlusion. symptoms differ according as there is **complete** or partial occlusion. In the first case very soon after birth **symptoms** of **ileus** occur. Meconium, as well as later on fæces, decomposes rapidly in the intestine, and gas develops, which produces **meteorism.** At the same time there is **vomiting** of food, later on of meconium. Singultus is also present. If the children are not operated on, they die on the fourth to sixth day, or sometimes as late as the thirteenth.

Partial occlusion produces symptoms according to the calibre of the

tube. In half of the cases it is so narrow as to equal complete occlusion. In the other half, while being small, it is not sufficiently so to endanger the life of the little patients, but even then they suffer from chronic obstipation and will finally contract chronic ileus.

If the rectum empties into the bladder or urethra, another complication arises, as very soon cystitis, with the formation of stones of the bladder and pyelonephritis, sets in and always proves fatal. Rectum empties into bladder or urethra.

The **prognosis** is exceedingly bad. All children with complete occlusion or insufficient opening die within a few days, unless an **operation** is performed. The latter is most urgently necessary and ought to be performed at once, usually not later than the second day. If the operation is done by that time, over sixty-three per cent of these cases will be saved.

Wounds.

Wounds of the rectum are of importance, first, for the hemorrhage, and secondly, for the unusual chances of infection, which must be prevented.

Diseases.

Of the many diseases of the rectum, anus, and its surroundings, we can only mention those which are strictly surgical.

An inflammation of the rectum may be due to an acute or chronic catarrh (proctitis) which is characterized by frequent discharges of glassy and, later on, putrid mucus. The patients are very irregular, suffering sometimes from constipation, sometimes from diarrhœa. The frequent evacuations finally irritate the skin of the anus and may produce fissures. Inflammation.

Specific inflammations are produced by gonorrhœa, ulcus molle, syphilis, or tuberculosis.

As mentioned before, the differentiation may be extremely difficult. All these diseases **produce ulcers** and, in later stages, strictures. The demonstration of specific bacteria decides the diagnosis. It is well to know that the **prognosis** is exceedingly grave, and that it seems advisable to recommend extirpation of the rectum in the early stages, as the ulcers do not usually yield to any other treatment, and the patients become cachectic if time is wasted in conservative treatment. Differentiation.

Fissure of the anus is a small superficial ulcer situated between two folds of the anus, producing pains and cramp-like paroxysms of the

sphincter. The **symptoms** are very **characteristic.** At stool, especially if obstipation is present, an exceedingly severe **pain** is experienced, which may even lead to fainting or spasms. Afterward sometimes a few drops of blood are passed. The pains are not **localized** at the original site only, but **radiate** to the lumbar region, territory of the sciatic nerve, and the bladder. Retention of urine may follow. The patients are afraid to have a movement, and postpone the same for that reason, only to increase the pain when it finally has to take place. The condition is so torturing that patients become morose, and sometimes inclined to suicide.

The diagnosis is nearly always easy. If hemorrhoids are present, a fissure must not be overlooked, as they are frequently combined. Examination has to be carried out with the greatest care, as it is very painful. The digital examination is not possible, except under general or local **anæsthesia.**

Diagnosis.

The only proper method of inducing local anæsthesia is by the subcutaneous or submucous injection of one-per-cent cocaine solution, or, still better, Schleich's solution (which represents a solution of 1 to 1000), which is quite as effective, and of which the necessary amount can be used without danger of poisoning.

PERIPROCTITIS.

Perianal and Perirectal Abscesses.

Inflammations and abscesses in the **tissues surrounding** the anus and rectum are very frequent. The different forms of these inflammations, resulting in abscesses, are subcutaneous, submucous, ischiorectal, and pelvirectal, all of which are **circumscribed** inflammations. Besides this, we find diffuse forms of suppuration.

Diffuse septic form caused by wounds.

The **diffuse suppurations** occur in two different forms: first, a diffuse septic form as a result of external wounds, accidental or by operation. They are especially dangerous if these involve the pelvirectal or retrorectal space, in which case the retroperitoneal tissue easily becomes infected. If this is the case, parts of the peritoneum and the gut may become gangrenous and thus produce **septic peritonitis.** The progredient phlegmon may spread over the perineum, scrotum, etc. Death usually ensues after two to eight days. The symptoms are those of acute sepsis and easily recognizable.

Besides this phlegmon we see, though rarely, a **cellulitis** with gas production (gas phlegmon) caused by bacterium coli. The **course** is decidedly **milder,** the temperature rises only a little or not at all. A local examination shows hardly any changes. Only a slight œdema in the subcutaneous tissue is to be observed, but after a while emphysema develops, and a small abscess which contains gas is formed. The granulations of the wound, if opened, are waxy and weak. The patients become sleepy and restless, finally somnolent. Gas phlegmon.

In other cases an apparently idiopathic gangrenous cellulitis develops, which starts either from the cutis or higher up, and is **characterized** from the first **by gangrene** of the skin and deeper tissue. The patients are usually lost, though sometimes early manifold deep incisions save the case. Gangrenous cellulitis.

The **circumscribed subcutaneous abscesses** are easily recognized. They are of importance, as they have a tendency to spread, either outward, or into the ischiorectal cavity, or upward into the submucous space.

The submucous abscesses are under the mucous membrane right above the anus. Their tendency is to spread either downward into the subcutaneous tissue, or upward. They **perforate** either through the Submucous abscesses.

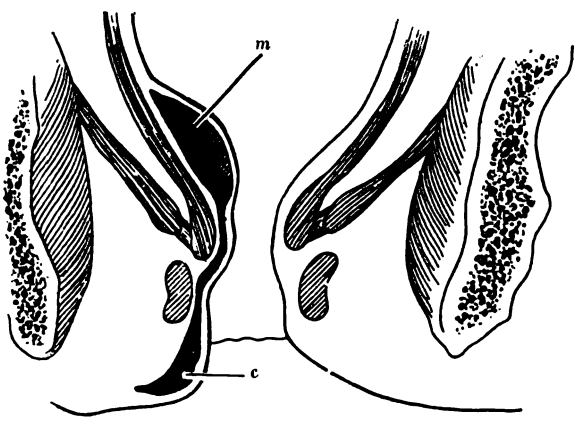


FIG. 8.—*m*, Submucous, *c*, subcutaneous abscess of the rectum.

skin, or most frequently through the anal mucous membrane, and thus present an anal fistula. They either develop in their acute form or become more chronic, especially in tuberculous individuals. They may then be easily overlooked, as they give practically no symptoms.

Ischiorectal abscesses are **rare.** If they are **acute,** they begin with

Ischiorectal abscesses.

violent septic symptoms and great local pains, tenesmus, etc. Examination shows a hard infiltration inside the sphincter. If they are not opened soon, the abscesses may **perforate** in different directions, either through the skin, or between external and internal sphincters, or above the internal sphincter. The pus may spread sidewise into the ischio-

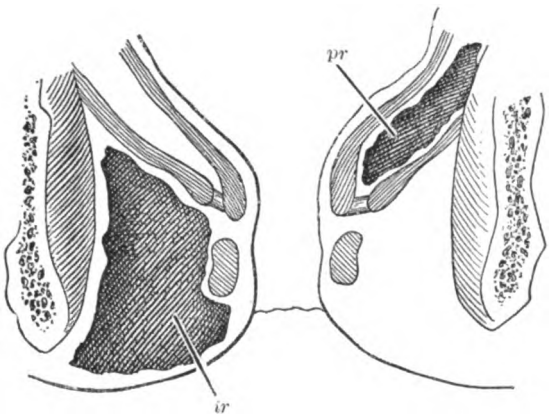


FIG. 9.—*ir*, Ischiorectal, *pr*, pelvirectal abscess of the rectum.

rectal cavity and thus, so to speak, surround the rectum in its circumference. These acute phlegmons of the ischiorectal cavity are of very **serious prognosis,** if not recognized and operated on promptly. The tuberculous forms take a chronic course and need prompt attention to prevent side channels, spreading, and perforation. The old mistaken conception, especially of English and American authors, that tuberculous ischiorectal abscesses and fistulæ are a surgical *noli me tangere* is without any foundation, and this tuberculous affection needs the same local treatment of opening, incision, scraping, tamponade, etc., as other surgical tuberculous diseases.

Pelvirectal abscesses.

The pelvirectal abscesses are due either to perforation of an inflammation of the rectal mucous membrane through the rectum, or more frequently to perforation of abscesses of the prostate. In the latter case they are in the anterior rectal space.

Other abscesses which may be found near the rectum may be due to perforative appendicitis and inflammatory diseases of the pelvic organs. But they really do not belong here, as they are intraperitoneal and have nothing to do with the rectum.

All these abscesses, of course, can be made out only by **digital examination,** and clinical experience in this line must be gained by ex-

amining every case presenting any symptoms indicating an involvement of the rectum, systematically, carefully, and thoroughly. The digital examination in rectal diseases is nearly as necessary and important as in gynæcology.

Fistula in Ano.

Most of the periproctitic abscesses, after they have burst spontaneously, do not heal completely, but result finally in a more or less narrow canal, surrounded by dense cicatricial tissue and covered with granulations.

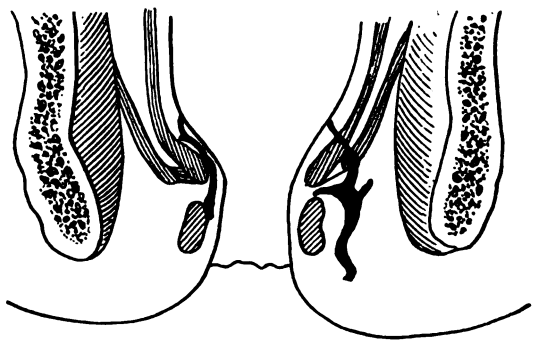


FIG. 10.—Internal Incomplete Fistulæ.

This **fistula is incomplete,** if it opens on one surface only, either skin or rectum. If the opening is inside the rectum, it is called **internal incomplete** fistula. If it is outside, it is called **external incomplete**

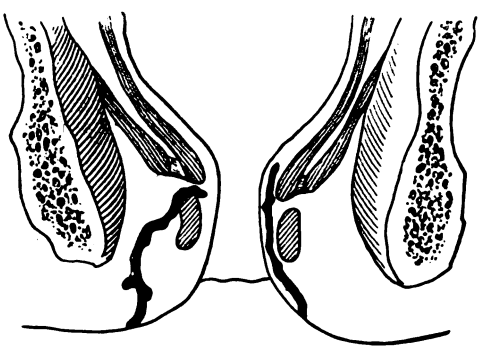


FIG. 11.—External Incomplete Fistulæ of the Anus.

fistula. If it opens on both surfaces leading from the rectum to the outer skin, not necessarily in a straight canal, it is a **complete fistula.**

These anatomical conditions can easily be ascertained with a **probe.**

The rule which I have mentioned so frequently, to use the probe only lightly without any undue force, must be observed in these cases also.

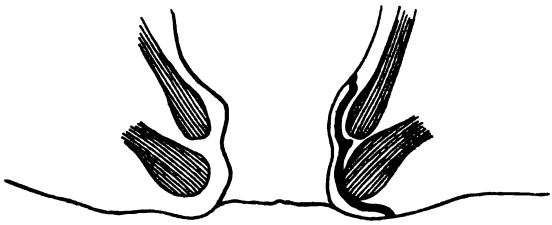


FIG. 12.—Complete Submucous Fistula of the Anus.

If the course of the canal is either crooked or divided, it may be impossible to reach the end of the fistula at the first attempt. If the fistula

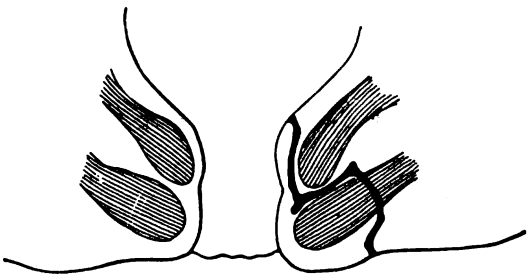


FIG. 13.—Complete Subaponeurotic Fistula of the Anus.

is not straight, there is usually more retention, so that the fistula in some parts really represents an abscess.

Incomplete external fistula.

In incomplete external fistulæ the probe very frequently leads right

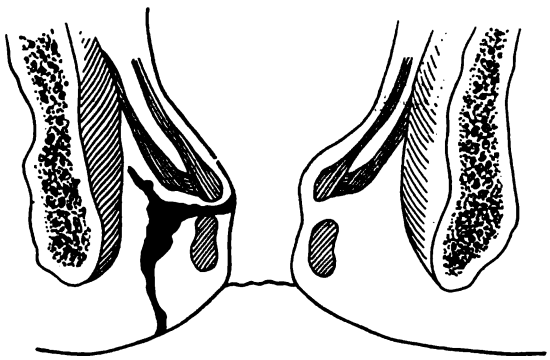


FIG. 14.—Ischiorectal Fistula of the Anus.

under the mucous membrane, but without entering the rectum. The **character of the fistula** is of importance, *i.e.*, if it is simply a result of

an acute periproctitis, which finally has not healed, or if the infection is of tuberculous nature. Examination of the pus and granulations for tubercle bacilli is exceedingly uncertain in its results, and if the clinical aspect leaves any doubt as to the nature of the fistula, **test-inoculation in animals** will establish the diagnosis.

Probing a fistula to determine if it is complete.

To find out if an external fistula is complete the probe is, as indicated above, inserted carefully into the fistula and the left index (covered with a rubber cot) is introduced into the rectum. The two hands then work together, to feel if the probe meets the finger. Frequently the probe has to be bent according to the shape of the fistula felt while introducing. This is, of course, done after the probe has been withdrawn, to be inserted again. Frequently many attempts are necessary to make out properly the course of a fistula. In many complicated cases of long standing, the true course of the fistula can be determined only during operation. The fistula is incised as far as the probe will go, and then its further direction has to be ascertained. If this is the case, we have at the same time the advantage of **narcosis.** The searching to find all blind sacs of a fistula has to be carried out most carefully, so as not to overlook any branching. It has to be stated that in extreme cases a fistula may practically encircle the rectum, and sometimes lead into unthought-of regions far off.

Operation.

Incomplete internal fistula.

The incomplete internal fistulæ are by far the most difficult to diagnose properly, as it is difficult to find the internal opening to insert the probe. If a hard cord can be felt, it makes the examination easier. If this is not the case, a speculum must be inserted and the inner surface of the rectum examined for the opening.

If a complicated **external fistula** is the result of **caries of a vertebra** or of some part of the pelvis, the external opening is usually in the posterior circumference at some distance from the anus, and the sound then enters, not in the direction of the rectum, but toward the pelvis or sacrum.

In regard to **tuberculous fistulæ,** it should be mentioned, in addition to what was said above, that far-advanced general **tuberculosis contra-indicates** an operation. In all other cases, complete cure is possible and probable.

Rectal fistulæ, connecting with other organs, lead either to the urinary or the genital tract. Communications with he urethra, bladder, or ureter are usually found in men, with the genitals mostly in women.

Perineal fistulæ may be mentioned here, although they have nothing

to do with the rectum, but are the result of a perforation of the **urethra** (either by injury or disease) leading in a more or less winding course to an exit, frequently situated near the anus.

The **diagnosis** is most simply made by administering to the patient a capsule of methylene blue. After a few hours the urine will be stained blue and the connection of the fistula with the urinary tract is easily recognized.

Recto-urethral fistulæ.

Recto-urethral fistulæ are usually the result of diseases of the prostatic and membranous urethra.

The **principal symptom** is the passage either of urine into the rectum or of gas or intestinal contents into the urethra. They usually do not occur both in the same individual. **Proctitis and urethritis** are constant symptoms in this disease, due to the reciprocal infection of these two organs. To make the diagnosis, an opening of the fistula in the rectum has to be found by digital examination or with the speculum, then a probe is introduced, to meet a sound passed into the urethra and bladder.

Diagnosis.

The **differentiation** of a recto-urethral fistula, if it is very far back, and a recto-vesical one may be difficult, but may thus be described (according to Tuttle):

Recto-urethral Fistula.	**Recto-vesical Fistula.**
Rarely congenital.	Comparatively often congenital.
History of urethral or prostatic disease.	History of peritonitis or intestinal disease.
Contents pass from one channel to the other only during functional action.	Contents pass abnormally without regard to functional action.
Amount of material passed is small and irregular.	Amount of material passed is large and constant.
Discharge is generally from the urethra into the rectum.	Discharge is nearly always from the intestine into the bladder (or vice versa).
Cystitis and frequent micturition rare.	Cystitis and frequent micturition always present.
Opening in rectum generally small and low down.	Rectal opening generally large and above the reach of the finger.
Sound in urethra can be felt by probe or finger in rectum.	Sound in urethra cannot be felt through rectum.

Recto-urethral Fistula.	**Recto-vesical Fistula.**
Colored fluids injected into bladder do not appear in rectum until micturition takes place.	Colored fluids appear in rectum immediately after injection into bladder.
Deposit of cicatricial connective tissue is generally large and easily felt with finger in rectum.	Deposit of cicatricial connective tissue is generally small and above the reach of the finger.

Recto-vesical Fistulæ.

Most of the symptoms of recto-vesical fistula are found in the table above. We have only to add that in this kind of fistula the **escape of urine** into the rectum **is constant,** but owing to the action of the sphincter of the rectum, the urine collected there need not be emitted constantly. The patients frequently control it. The presence of fæcal discharge into the bladder usually has to be determined by microscopical examination of the urine. Additional symptoms.

The cystoscope enables us **to find the opening of the fistula** in the bladder, and possibly to observe fæcal discharge into the same, but, of course, it is impossible to introduce a sound from the bladder, therefore the **course** of the fistula has to be **determined from the rectum.** If it enters the rectum high up, it may be difficult to find and a long proctoscope has to be used.

The prognosis is exceedingly grave, the results of operations not very encouraging. Prognosis.

Recto-genital fistulæ are canals connecting the rectum with the uterus, the vulva, or the vagina. Their description belongs to the gynæcological part of surgery, and therefore is omitted here.

Strictures of the Anus and Rectum.

Strictures of the anus are practically solely the result of ulcers in the anal region, or of operations, for either hemorrhoids or fistulæ. The so-called Whitehead operation has been responsible in a good many cases.

The principal **symptom** of stricture of the anus is great pain during defecation. Local inspection and examination will easily reveal the condition.

The **strictures of the rectum** are due either to inflammatory proc-

esses in the perirectal tissue, or to chronic inflammations of the rectum itself. The three diseases responsible mostly for strictures of the rectum are gonorrhœa, tuberculosis, and syphilis, besides carcinoma, which will be described later on. All these three diseases form ulcers in the mucous membrane, and later on in the muscular layer of the rectum, which result in scars and finally produce a stricture. The form of the stricture in all three is annular or cylindrical, of greater or shorter length. If the strictures are not high up, they are easily found by **digital examination,** while high strictures can be seen only through a long proctoscope with an electric light, the patient being in proper posture.

Causes.

Symptoms.

The general symptoms are those of a **chronic proctitis,** which usually has been existing for a long while. Mucus and pus, sometimes accompanied by blood and shreds of mucous membrane, are discharged.

To determine a stricture and its site by a **bougie,** we must remember what I have mentioned repeatedly, that the thickest bougie is always the safest. Thin bougies very often get caught in the mucous membrane, and if so arrested, may lead to the mistaken assumption of a stricture. The exact distance of a stricture from the anus is measured by the above-described bougie *à boule,* which in passing the stricture gives the feeling of a resistance overcome, and becomes hooked, so to say, on attempt to withdraw. All these examinations should be repeated to make sure of the diagnosis.

To locate the stricture.

If the existence of a stricture has been proven, it is to be remembered that in all non-malignant strictures there are **ulcers above the stricture,** the nature of which can be determined only by proctoscopy; but even then the **differentiation** may be exceedingly difficult, as the characteristic form of the ulcers finally disappears, and we find that chronic state of general infiltration and loss of epithelium, which makes clear distinction difficult, if not impossible. The general symptoms are, of course, in all alike, the discharge, as well as loss of flesh from malnutrition.

Differential diagnosis.

The differential diagnosis between malignant and non-malignant strictures will be given under the heading of carcinoma.

These three diseases, resulting in strictures, represent a very grave affection, the **prognosis** of which must remain doubtful.

To make any rational treatment possible, an **artificial anus** has to be established to set the ulcerated part of the rectum at rest, so to speak, but even then the affection will really heal in rare cases only, and early **extirpation of the rectum** ought to be recommended.

Hemorrhoids (Piles).

Hemorrhoids are exceedingly frequent. They are found more in men than in women, and more after the thirty-fifth year than before. Frequency. **Etiologically** a great many things have been made responsible for them: lack of exercise, chronic constipation, high living, etc.

If we observe the effect of increasing the **blood-pressure** by abdominal pressure, if we see how existing hemorrhoids become dark, cyanotic, swollen, protruding and hard if the patients bear down, the connection of blood-pressure and these varices of the hemorrhoidal venous plexus is clear; but this increased pressure, used especially by persons with chronic constipation, does not and cannot enlarge sound veins, but only those in which an **endarteritis** has brought about the weakening and loss of elasticity in the walls of the vessels.

To **differentiate** between external and internal hemorrhoids, the external hemorrhoids present the well-known picture of bluish nodules, the size of which varies from a pea to a hazel-nut. They swell up by bearing down and can be emptied by digital pressure. They hardly ever bleed and give very few symptoms until they become inflamed, when they produce the so-called **hemorrhoidal attack,** which is an acute thrombophlebitis with all its symptoms. The nodules become very painful, swell up, pulsate, and produce tenesmus. They are exceedingly **tender on pressure** and examination has to be carried out very carefully. These attacks last only a very short time, or from six to eight days, after which all the symptoms disappear more or less, or the inflammation ends in suppuration, leading to the formation of a fistula. External hemorrhoids.

Internal hemorrhoids are above the sphincter and consist of a number of nodules of different sizes, arranged in circular form. The nodules are soft, and are usually covered by mucous membrane, which is either greatly changed by former inflammations, or covered by fine granules of bright red color; the latter bleed at the least touch. Large internal hemorrhoids frequently give the feeling of pulsation. The **principal symptom is the hemorrhage** usually occurring with the stools. The quantity changes from a few drops to half an ounce, or an ounce. Really profuse hemorrhages are rare, but do occur. Even small hemorrhages, if constant, may produce serious anæmia. Well known is the fact that a great many patients with hemorrhoids feel very much depressed, apparently out of all proportion with the seriousness of the affection. The Internal hemorrhoids.

internal hemorrhoids may prolapse, and then become incarcerated by reflex spasm of the sphincter. This results in **acute phlebitis,** of which the **symptoms** may become quite **severe.** Reposition becomes impossible, the pains are unbearable, tormenting tenesmus, sometimes reten-

FIG. 15.—Incomplete Prolapse of the Anus and Rectum.

tion of urine, high temperature, and vomiting result. The nodules become gangrenous and ulcers form, which finally may heal.

Another symptom of internal hemorrhoids is **proctitis;** this shows itself in the discharge of mucus, which finally may become very diffuse and produce eczema.

Examination. The examination for hemorrhoids is best done in Sims' position, or an exaggerated lithotomy position, as described above. The patients are to bear down.

Internal hemorrhoids, which have not prolapsed, must be inspected with the aid of the **speculum.**

Prolapse of the Anus and Rectum.

In prolapse of the **anus,** the abnormally thickened (usually as the result of chronic diarrhœa) mucous membrane of the anus and the lower part of the rectum protrude, but in the beginning can usually be easily replaced. If this condition exists for any length of time, the **rectum** as such, in all its layers (not only the mucous membrane), may follow, or the rectum in its entire circumference and thickness may descend from the start. The prolapse usually appears during and after defecation. If it cannot be replaced, **ulcers** develop in the later stages, on the exposed mucous membrane. At the same time pronounced swelling exists, which may develop to such a degree as to produce **gangrene.**

For a better conception of the somewhat complicated anatomical conditions, we need only look at the accompanying pictures.

Prolapse is most frequent in **children.** As etiological factors we have diarrhœa, worms, phimosis, stone in the bladder, whooping- Etiological factors.

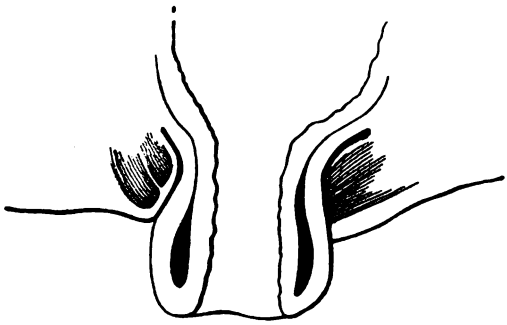


FIG. 16.—Complete Prolapse of the Anus and Rectum.

cough, unusually long mesentery of the sigmoid flexure, polyps of the rectum, and congenital stenosis of the rectum. In later life it is rarer, and occurs then mostly in women after multiple birth. In old age it

FIG. 17.—Intussusception of the Rectum.

becomes again more frequent, owing to general laxity of the tissues. Besides the **local symptoms** which easily lead to the diagnosis, there is always partial or complete incontinence.

If the prolapse changes from a cylindrical form into a more spheric

one, it usually indicates that one or more loops of another part of the intestinal tract have fallen into the vesico-rectal peritoneal fold. Thus even an **incarceration of such a hernia** may take place.

The conditions of the peritoneum in the different forms of prolapse may be seen in the schematic drawings.

Neoplasms of the Anus and Rectum.

The anus is very frequently the site of **condylomata acuminata,** most frequently found in women, and usually due to gonorrhœal discharge. When they occur without this specific affection, they must be **differentiated** from condylomata lata, which belong to the secondary symptoms of syphilis.

The **acuminata** have the appearance of pointed small warts, which are always multiple and may, by excessive proliferation, present a cauliflower appearance. The prognosis is absolutely good and the little tumors do not recur, after they have been removed.

Carcinoma of the anus.

Cancer of the anus is extremely **rare,** but, strange to say, shows a much **worse prognosis** than cancer of the rectum. It usually appears in the form of an infiltration or an ulcer. In the flat form it has high walls, while the deep form becomes crater-like and usually envelops the sphincter, sometimes producing papillary excrescences. The **inguinal glands** are very soon infected and frequently the glands in the neighborhood of the sciatic nerve, thus giving intense pain. If the sphincter is destroyed, complete incontinence, of course, ensues.

The **tumors of the rectum** are, for diagnostic purposes, best divided into benign and malignant tumors.

Benign tumors of the rectum.

Among the **benign** tumors we find fibromas, lipomas, and myomas. They usually form small tumors not larger than a hazel-nut, and bulge out the mucous membrane under which they lie, starting from the connective tissue. They may thus simulate polyps. The benign tumors starting from the epithelium of the mucous membrane are polyps, papillomas (villous tumors), and the multiple small polyps which are usually described as polyposis recti.

The simple **polyps** are usually situated in the lower third of the rectum, mostly at the posterior wall. They are generally unilocular, and rarely reach a size larger than a walnut. The **symptoms** may be very indistinct, so that an examination of the rectum is not thought of until a hemorrhage takes place, or until the polyp prolapses.

The **villous tumors,** according to their coral-like formation, are exceedingly prone to cause hemorrhages and proctitis with diarrhœa, and frequently prolapse. The **prognosis** is not so good, as they have a tendency toward carcinomatous degeneration.

Polyposis recti.

Polyposis recti is a curious disease, affecting the rectum and the largest part of the colon, in which the mucous membrane is covered with polyps not exceeding the size of a pea and forming besides this a number of larger tumors. It usually affects younger people below thirty. The **symptoms** are those of a chronic colitis, with copious stools mixed with mucus and blood, followed by tenesmus, and even incontinence. The patients lose flesh, and usually die after from two to ten years. The **prognosis** is very poor. In some cases carcinoma develops on the basis of these adenomas.

The **malignant** neoplasms are represented by carcinomas and **sarcomas;** the latter are extremely **rare.**

Carcinoma of the rectum.

Carcinoma of the rectum occurs twice as frequently in men as in women, and in both sexes usually after forty. Only the **gelatiniform** cancer mostly attacks younger people under thirty.

STRICTURES.

	NON-MALIGNANT.					MALIGNANT.
		INFLAMMATORY.				NEOPLASTIC.
	Congenital.	Simple.	Gonorrhœa.	Tuberculosis.	Syphilis.	(Carcinoma.)
Age	Often unobserved until puberty.	Adult	After puberty.	After twenty.	After puberty.	After forty.
Etiology		Trauma, inflammation of other pelvic organs.	Gonorrhœa, often still existing.	Other organs affected by tuberculosis.	Syphilis infection, sometimes local.	Piles.
Sex	Both	Trauma in men, inflammation in women.	Women	Both	Women more frequent.	Men more frequent.
Seat	Low, one-half inch above anus.	Anywhere in rectum.	Two and one-half to six inches above anus.	Two and one-half to six inches above anus.	Two and one-half to six inches above anus.	Usually not above four to four and one-half inches.
Ulceration	None	Only submucous ulceration, producing stricture; usually single.	Irregular large ulcer (one).	Loss of entire mucous membrane in entire ulcer.	In patches, with normal or scar tissue between; indurated wall.	One deep ulcer (in late stages) with high, hard wall.
Discharge	None	None or mucus.	Mucus, blood, pus; Neisser coccus rare.	Profuse mucus, blood, pus; tubercle bacilli rare in later stages.	Profuse mucus, blood, and pus.	Profuse mucus, blood and pus; shreds of tumor.
Consistency	Not very hard.	Rather hard	Hard	Hard	Very hard	Hard and brittle.
Course	From birth, all through life.	Many years	Two or three years.	Two years	Two years	One to two years.
Prognosis	Fair	Fair	Bad	Bad	Bad	Fatal.
Frequency	Very rare	Rare	Very rare	Rare	Rare	Frequent.

Unfortunately it gives practically **no symptoms,** slight dull pain during passage excepted, until the carcinoma begins to **ulcerate,** when increased discharge and passage of blood are observed, or until **stenosis** is formed. That is one of the reasons why carcinoma of the rectum usually comes rather late under the observation of the physician. The most frequent form of carcinoma, situated in the ampulla of the rectum, at first involves usually only a part of its circumference; but in seventy-five per cent the tumor encircles the entire rectum when it comes to observation.

As mentioned above, **all cases of piles** ought to be examined by palpation for a possible cancer, as they seem to be a frequent cause of its development.

Digital examination.

Inspection usually shows no local symptoms, except where the anus is involved, unless the carcinoma is so far developed as to produce cachexia. The digital examination reveals, in those cases in which the tumor is not situated too high (which is the exception), the presence of an **irregular, usually ulcerated tumor with indurated walls,** which is easily differentiated from the soft, unaffected parts of the rectum. If a stenosis is formed, the tip of the finger reaches a hard callous ring, reducing the lumen of the rectum considerably. If the stenosis is permeable, and if we can reach above it, the carcinoma generally extends behind it. On withdrawal of the finger we usually observe blood, mucus, detritus of an extremely offensive **smell,** which is **characteristic for carcinoma.** It has an odor *sui generis,* which can never be forgotten after one experience.

Diagnosis.

All other tumors and stenosis of the rectum are so rare, compared with carcinoma, that in most cases the suspicion of a cancer is justified. In those cancers, about ten to twelve per cent, which are situated high up and not to be reached by the finger, the presence of a tumor can be established only on examination with a long proctoscope. The examination with the speculum is, of course, indicated in all cases of tumor or stenosis.

One **symptom of cancer** of the rectum **situated high** up and of those of the sigmoid flexure, consists in the fact that the walls of the ampulla do not touch as they do under normal conditions, but gape by aspiration, so that the ampulla appears to the examining finger as a wide empty space, whose walls can be touched only after the finger is bent. In some cases in which the diagnosis is absolutely impossible, probatory laparotomy has to be resorted to.

Sarcomas are differentiated from carcinomas by forming spherical and softer tumors, which are covered by normal mucous membrane until the tumor ulcerates. Differentiation.

For differential diagnosis, cf. the table below.

	Adenoma.	Papilloma.	Carcinoma.
Age	Adults	Adults and in advanced life.	After forty.
Sex	More frequent in women.	Equally in both sexes.	More frequent in men.
Seat and number	Anywhere from anus along entire colon, often involving large areas; multiple.	One to three tumors close together, usually in lower parts of rectum.	Usually not higher than four inches from the anus, or right above the anus; single. Later on, encircling.
Size	Small to hazelnut...	Two to three inches in diameter, consisting of pea-sized lobules.	Involving one to two inches in length.
Consistence	Soft and elastic.....	Soft and villous.....	Hard, especially walls, stiffening the entire thickness of gut.
Pedicle	Thin, short.....	Broad, long.	
Functional symptoms.	Diarrhœa, hemorrhage (very early).	Constipation more frequent than diarrhœa; hemorrhages irregular or periodic.	Constipation in the beginning, later diarrhœa.
Discharge	Mucus; later, blood.	Sticky mucus.....	Mucus; later, pus and blood.
General symptoms....	.....	Anæmia and early exhaustion.	Cachexia after tumor ulcerates.
Extension	....	.....	By continuity; metastases; affection of glands.
Odor	If decomposed blood is present, offensive; otherwise, not.	No particular odor..	Specific carcinomatous odor.
Prognosis	May develop into cancer. If large parts of rectum and cæcum affected, grave.	Usually good.....	Fatal; but slower than other cancers.
Recurrence	None.....	None.....	Frequent.
Frequency	Rare.....	Extremely rare.....	Frequent.

As soon as the diagnosis of carcinoma of the rectum is established, immediate **extirpation** of the entire growth is indicated, if feasible. **Extirpation of the rectum** is indicated if the growth is movable, and does not involve other organs, if no metastasis can be found, and if the general condition of the patient is such as to warrant such a serious and bloody operation. The results as to radical cure are not discouraging; in fact, Operation.

much better than the average carcinoma operations offer. Fifteen per cent of cures seems to be a conservative estimate (cases are regarded as cured if the patients have lived three years or more without recurrence). As to the functional result of the operation, thirty per cent have complete sphincteric control, sixty per cent partial or relative control, and ten per cent show incontinence. These figures can surely be improved upon, if the diagnosis is made in an earlier stage, *i.e.*, if the general practitioner will learn to use digital examination in searching for a possible carcinoma, where comparatively slight symptoms of intestinal disorder indicate even a suspicion of the possibility of a carcinoma of the rectum. It is entirely in the hands of the family physician to reduce the mortality from this disease.

The former rule, not to attempt operation where the upper limits could not be made out with the finger, has been abandoned, and the opening of the peritoneum, usually necessary in those cases, has not increased the mortality of these operations, but has on the contrary saved a great many cases formerly lost.

The **prognosis** has been materially **improved** since it has been customary to make preliminary colostomy before extirpation. In case extirpation appears impossible or should be refused by the patient, colostomy should not be recommended until absolutely necessary by reason of stenotic symptoms, as the existence of a patient with an anus *præternaturalis* is not an enviable one; this operation shows the patient at the same time the hopelessness of his case. I may mention here that I have made it a rule, which I follow with very few exceptions, not to inform patients with inoperable cancer of their condition, but to tell a responsible member of the family. We may meet, of course, conditions where, for the family's sake or for financial or business reasons, it may become necessary to inform the patient himself.

INJURIES AND DISEASES OF THE LIVER AND GALL-BLADDER.

SUBCUTANEOUS INJURIES OF THE LIVER.

Rupture.

The subcutaneous injuries of the liver, rupture, etc., are usually followed by the general symptoms of injury of any visceral organ; but it is also necessary to know that the liver can be ruptured without any symptoms of **shock or collapse**, though this is rare. Usually they are both present. The principal symptom is that of **hemorrhage** which is usually very profuse. The blood generally collects in the right side of the abdomen.

For **differential diagnosis** it is important to know that the blood rarely descends into the small pelvis as, for instance, a hemorrhage from a ruptured spleen will do. If the hemorrhage persists, the patients become anæmic, with feeble high pulse, groan, and complain of violent local pain. The pain between the shoulder-blades, mentioned as characteristic, is frequently absent. **Icterus** occurs in only about twenty per cent, and not before the third or fourth day. Glycosuria has been observed so rarely that this symptom is not of much value.

Bilious vomiting and singultus are not specific. Labored respiration and tormenting cough are frequently caused by simultaneous fractures of the ribs, and injuries to the diaphragm and lungs.

In rare cases the tear in the liver can be felt by palpation. Usually abdominal tenderness prevents any exact palpation.

Wounds.

Open injuries of the liver usually bleed very profusely. Discharge of bile does not often occur before the fifth day. Otherwise the symptoms are identical with those of subcutaneous injury.

The **diagnosis** may be exceedingly difficult for the reasons mentioned above, but if after each severe contusion of the right side of the thorax and the abdomen, the genesis of which we have carefully investigated, the pulse and heart are watched with care, and if we search diligently for eventual **intraperitoneal hemorrhage**, we can hardly overlook an injury of the liver.

The **prognosis** is not by any means as hopeless as is generally supposed. In the first place bile as such is usually sterile, if not actually antiseptic, and therefore septic peritonitis is not apt to follow such an injury. Secondly, we know that the **liver** is the only organ in the human anatomy which is **capable of reconstruction.** Patients have lived after the loss of more than two-thirds of the liver; therefore, as soon as an injury of the liver is made out, immediate operation is indicated. In some cases, especially of shot-wound, the exact extent of the injury of the liver cannot be ascertained until exploratory laparotomy in the mesial line has been made.

Injuries of the gall-bladder.

Injuries of the gall-bladder and its ducts present symptoms similar to those of the liver. Icterus appears only after the bile, which has escaped into the abdominal cavity, is absorbed. The abdomen is slightly distended. If, in penetrating injuries of the region of the liver and gall-bladder, pronounced **flow of bile** occurs, the injury more probably proceeds from the gall-bladder than from the liver. If the stools are perfectly colorless, the injury is probably situated in the choledochus.

The diagnosis of injuries of the gall-bladder and its ducts necessitates immediate laparotomy. The **prognosis,** like that of injuries of the liver, has grown decidedly better in recent years.

Cholelithiasis.

By far the most frequent disease of the liver and gall-bladder is **gall-stones.** Formation of stones is due to stagnation of bile. The immediate cause is given by the invasion of bacteria, probably bacterium coli. The disease is much more frequent in women than in men, is very rare in children, and increases in frequency with age.

The **stones are formed** in the gall-bladder and are therefore found mostly in that organ, or the cystic duct, or the choledochus; nevertheless it is not very rare to find stones in the intrahepatic ducts. The stones are usually **multiple,** sometimes several hundreds, and are then frequently facetted. If they are solid, they attain **large size,** walnut to egg size and larger, and have a rough surface. Frequently one stone wedged in the neck of the gall-bladder is the largest of the set (**keystone**).

Symptoms.

In many cases cholelithiasis does not produce any symptoms. Frequently the patients complain only of a slight dull pain, which they usually call stomach-ache. In an acute attack the **pains are characteristic;** they may occur in a mild form, or with furious intensity, but

their degree is not relative to the seriousness of the attack. The pain is **localized** in the region of the gall-bladder, which is distinctly tender on pressure. In many cases a tumor can be palpated. This usually is due to an abnormal filling of the gall-bladder in cholelithiasis. While the stones can rarely be felt, in some instances grating of the calculi can be detected. If an infection from the gut has taken place, **general symptoms** are present, as fever, which becomes of an intermittent character if pus is formed in the bladder (empyema). If after a number of attacks the gall-bladder is shrunken, the organ cannot swell.

Icterus is present in only about twenty per cent of gall-stone colic. It is frequently, but not necessarily, observed if a stone has become impacted in the choledochus. If the choledochus is thus closed for any length of time, intestinal disorders are present.

Discharge of stones **per rectum** is not very frequent. If they are larger than a cherry-stone they have passed through a slowly forming fistula, the formation of which may take place without any serious disturbances. The attacks usually are repeated after a shorter or longer interval. Sometimes years elapse before a new one occurs.

In the free interval the diagnosis is sometimes difficult or impossible, but even then we find a distinct tenderness in the region of the gall-bladder, on attempting to shove the liver upward in deep inspiration. Diagnosis.

The **anamnesis** is of great importance. If **cramps** in the stomach region have been observed with vomiting and subsequent jaundice, and if this course extends over years, the diagnosis of gall-stones is probable. This becomes more so if **stones are passed** with the stools, and if we find a painful tumor which can be moved more or less freely, but returns again to the same constant locality. Usually the tumor is hard.

Exploratory puncture is not allowed under any circumstances.

The *x*-rays are so far without much diagnostic value, as it is very difficult, and possible only under very favorable circumstances, to get a shadow of the stones. Only a positive result would therefore be of any value.

The **diagnosis of gall-stones** is therefore in many cases not difficult, but usually **not sufficient,** as the simple fact that stones have been diagnosed does not indicate any operation. Therefore we must endeavor to specify the diagnosis, trying to find out **where stones are located,** and what the condition of the gall-bladder is. This is in many cases possible by establishing a very exact anamnesis, by observing the case carefully, and by a thorough examination. The most valuable information we get

Method of palpation.

from palpation in bimanual examination. This is carried out in the following way: The patient lies on his back with knees drawn up. The examiner faces the patient, standing on his right side, places his left hand flat in the region of the kidney and the right one in the gall-bladder region. He now tries to lift the liver and gall-bladder upward with the left hand toward the right hand, which palpates carefully and lightly. Any undue pressure of the right hand has to be avoided, as it will immediately produce a cramp-like reflex of the rectus, thus obviating any further efforts.

Differential diagnosis.

We may mention here the **differential diagnosis from movable kidney.** The gall-bladder tumor can often be pressed downward, but returns at once to its place. The kidney has a characteristic form of its own, and slips out between the opposing finger tips with a snap, so to speak, as a bean springs from the pod when squeezed. If the colon is inflated, the movable kidney usually disappears behind it, except when the kidney has descended very far down. The tumor of the gall-bladder is usually, though not always, shoved upward by this procedure.

The **differentiation from the diseases of the stomach** rests on the chemical examination of the contents of the stomach.

Echinococcus of that part of the liver near the gall-bladder may be mistaken for hydrops of the gall-bladder. It is to be noted in this connection that frequently, during an inflammatory attack, we find the formation (often within a few days) of a tongue-shaped lobe of liver over the gall-bladder (Riedel's lobe).

If the clinical picture of gall-stone disease is well defined, we must try to ascertain in which of the following stages it is:

Occlusion of the choledochus.

Acute occlusion of the choledochus is characterized by the appearance of pronounced icterus during or after a typical colic, accompanied by vomiting and frequently by fever. The pain radiates toward the breast and the back.

Chronic occlusion of the choledochus frequently runs its course without any distinct swelling of the gall-bladder or the liver (in many cases the gall-bladder is shrunken). The fever is intermittent and irregular, jaundice and coloring of the stools are very uncertain. Spontaneous pains are usually present. Frequently a spleen tumor can be palpated. The patients become much run down and cachectic, and show a tendency to mucous-membrane hemorrhages.

Acute cholecystitis, inflammation of the gall-bladder, **differs in its**

symptoms according to the state of the gall-bladder. If the latter has undergone little or no changes, then the wall of the gall-bladder swells acutely. The liver does not swell up. Riedel's lobe above the gall-bladder is formed. Icterus is present in only ten per cent. There is violent pain, spontaneously and on pressure. Peritoneal crepitation (doubtful) and fever are sometimes present. The general condition of the patient is frequently grave. Cholecystitis.

If the gall-bladder has shrunk from frequent inflammations, the acute cholecystitis is usually characterized by obliteration or stenosis of the cystic duct, or manifold adhesions in the surroundings of the gall-bladder. The gall-bladder may be so small that it can hardly be found during operation. Jaundice and tumor are usually absent. If empyema exists at the same time, high fever occurs, with chills, and grave general symptoms of sepsis are possible.

Empyema of the gall-bladder in cholelithiasis is characterized by spontaneous pain and a tumor, tender on pressure, in the gall-bladder region. Fever and chills are frequent, but sometimes absent. Often **symptoms of a local peritonitis** (meteorism, vomiting, slight ascites) are present. Stones are usually not passed. Empyema of the gall-bladder.

Acute perforation of the gall-bladder is characterized by the symptoms of other perforations, as exceedingly violent exacerbation of pain, sudden collapse, crossing of the pulse and fever curve (pulse going up, temperature coming down); the abdominal walls are stiff, hard as a board; later on, the abdomen becomes slightly distended, and ascites is noted. In subacute cases, the perforation may be accompanied by less violent symptoms.

Chronic occlusion of the cystic duct is characterized by an elastic tumor of the gall-bladder (hydrops), frequently pain in the stomach, no swelling of the liver, no icterus, no passage of stones. A tongue-shaped liver-lobe (Riedel's) is frequently found. Chronic occlusion of cystic duct.

All these different types occur in their described form, but, of course, a great many cases show intermediate forms, with the symptoms which belong to another group, while some of those symptoms described as characteristic are lacking.

If, in a first attack, the gall-bladder can be felt, we have to deal with either **hydrops or empyema** of the gall-bladder. If we feel the gall-bladder in a chronic recurrent case of cholelithiasis, and there is no icterus, we have to deal with a hydrops, rarely with an empyema. If icterus is present in those cases, stones are in the neck of the gall-bladder or the Differential diagnosis.

cystic duct. If the tumor of the gall-bladder diminishes or disappears, while the jaundice persists or increases, the stone has been shoved forward from the cystic duct into the choledochus. The presence of fever, especially if intermittent and accompanied by chills, speaks for incarceration of the stone anywhere, and indicates empyema. The differential diagnosis may be difficult in complicated cases.

Movable kidney and diseases of the stomach, so far as they come into question in the differential diagnosis, I have mentioned above.

In acute attacks we have to exclude **stones of the kidney,** which are characterized by frequent micturition with small quantities of urine, radiating pain along the ureter and urethra, tenderness of the kidney and ureter.

Appendicitis has frequently been mistaken for gall-stones, and vice versa. Appendicitis is usually, of course, localized lower down and more outward, but in atypical cases mistakes may occur.

Carcinoma of the gall-bladder and liver.

In carcinoma of the gall-bladder and the liver, the edge of the liver feels exceedingly hard, and frequently free ascites is present, but with all care and experience the best diagnosticians are sometimes surprised in gall-stone diseases.

Indication.—As mentioned above, the simple diagnosis of gall-stones does not imply, as such, an operation. To lay down conservative rules for operation, we may say that operation is indicated (1) in acute purulent cholecystitis and in chronic occlusion of the cystic duct, as internal treatment is powerless in those cases; (2) even if no immediate danger exists, but if the constant colics and pains, in spite of rational treatment, deprive the patient of enjoyment of life and impair his capacity for work. Many patients become addicted to morphine and, besides, desire an operation. Finally **operation** is, of course, **strictly indicated** if we have reason to believe that a **carcinoma** of the gall-bladder exists. The last indications do not very frequently have to be followed, because usually those carcinomas of the gall-bladder which can be felt as a tumor are inoperable. In the diagnosis of the presence of pus, counting the leucocytes is of great value. If they are constantly on the increase, and exceed 20,000, an early operation is necessary. As for the second indication, it is entirely relative, a compromise, so to speak, that poor people who have to work and cannot take care of themselves need an operation more than people of ample means. If patients become depressed in their mind and lose all interest in life from the con-

Leucocytes.

stant suffering, operation becomes a necessity, even if the diagnosis cannot be made out exactly in all its details. If by shrinking and adhesions the pylorus becomes involved, with symptoms of stenosis, operation must be advised. As to the **time of the operation,** the latter should not be postponed too long if jaundice is present, for then the results become very much less favorable and cholæmia, with its tendency toward hemorrhages, ensues.

Contraindication.—Rare attacks with little discomfort do not call for an operation. Frequent light attacks with icterus and frequent discharge of small stones permit an expectant treatment, especially if the patients are perfectly well between the attacks. Ascites usually contraindicates an operation. The general condition of the patient may make the operation very undesirable, as, for instance, diabetes, extreme corpulence (this makes the funnel of the wound much deeper and therefore the whole operation exceedingly more difficult), advanced arteriosclerosis, heart disease, and advanced disease of the lungs. If deep icterus (bronze icterus) has been existing for several months, with or without hemorrhages of the mucous membrane, operation is contraindicated because of the great danger of parenchymatous hemorrhages. Besides, the blood of such patients does not coagulate readily. Advanced carcinoma of the gall-bladder is inoperable.

Mortality.

The mortality has vastly decreased in recent years. If all complicated cases are included, perforations, purulent peritonitis, sepsis, etc., the mortality reaches fifteen per cent, while the opening of the gall-bladder and removal of stones shows only two, and the extirpation of the gall-bladder three per cent.

Results of operation.

The difficulty is, that it is impossible to say beforehand what complications may be met with during operation, which special operation will have to be performed, and therefore what the chances are. It cannot be denied that all gall-bladder operations are still to be considered as grave. Frequently **fistulæ,** discharging sometimes immense quantities of bile, persist for a long while, but most of them will finally close spontaneously. Even when no stone has been overlooked, and the cystic duct has not been kinked by adhesions, a very disagreeable after-complication may be **cholæmia** (hemorrhages in stomach and intestines) and cholæmic vomiting. The final result of the operation is usually lasting; while the possibility of **recurrence,** new formation of stones, cannot be denied, it is practically extremely rare. If the trouble returns it will be because some stones were overlooked, or because adhe-

sions had formed, which interfered with the success of the operation. All these disadvantages are obviated if the gall-bladder is extirpated whenever possible, which is by far the most rational operation.

Hydrops of the Gall-Bladder.

Besides the usual **cause,** the presence of stones in the cystic duct, retention of bile in the gall-bladder may be due to a kink in the duct, or to old adhesions. Quite frequently the compression of the bile-passages is caused by a malignant tumor growing in that region.

Diagnosis. Therefore hydrops of the gall-bladder is really only a **symptom of other pathological conditions.** It is recognized by the presence of a spherical or pear-shaped tumor, which reaches below the free edge of the liver. The **tumor moves with respiration,** but it always returns to its former position; no tenderness; the consistency is elastic; fluctuation is only rarely to be felt. If **ascites** is present, it **indicates a malignant** tumor; icterus is rare. If the hydrops is very large, it may be mistaken for **other cystic tumors,** as an ovarian cyst or hydronephrosis. The former ought to show its connection with the genital apparatus, the latter is retroperitoneal, and undergoes rapid changes of size.

Echinococcus cysts, if they are pedicled, may be hard to differentiate from hydrops of the gall-bladder.

Exploratory puncture is absolutely forbidden.

Indication for Operation.—As long as no inflammation occurs in the hydrops, the only indication for operation is the very large size of the gall-bladder and its rapid increase, which makes a bursting of the gall-bladder probable, with its danger of infecting the peritoneal cavity, or if the tumor, although elastic, exerts pressure on neighboring organs.

Contraindication.—If the hydrops is the result of a **malignant** tumor, we should operate only in exceptional cases. **Jaundice** of long standing always **contraindicates** gall-bladder surgery. The simple opening of the gall-bladder and establishing a fistula (cholecystotomy) is practically without danger. The more rational extirpation of the gall-bladder has had so far a somewhat higher mortality.

Empyema of the Gall-Bladder.

Cholelithiasis has been named as one of the predisposing factors for empyema, which is **directly due to infection** from the intestine. Besides gall-stones, a number of acute infectious diseases are directly responsible

for empyema of the gall-bladder, as typhoid, pneumonia, dysentery, pyæmia, etc. If hydrops, due to any of the above-named causes, becomes infected, empyema results.

If stones are not present in empyema, the tendency of ulcerative processes to **perforate the wall of the bladder** is very great, but very frequently **adhesions** are formed, so that the perforation does not discharge the contents into the open peritoneal cavity, but into a preformed space, analogous to the perforation of some ulcers of the stomach.

Symptoms.

The principal symptoms of empyema are local tenderness and cystic tumor of the gall-bladder. Pain, both spontaneous and on pressure, is felt during deep inspiration. The tumor of the gall-bladder can easily be felt, except where adhesions of the omentum have formed. **Fever** is nearly always present, and either continuous, remittent, or intermittent in its character. **Leucocytosis,** from 20,000 upward, indicates empyema. Local peritonitis is frequently present, with vomiting, meteorism, temporary paralysis of the gut, etc. The presence and intensity of jaundice are parallel to the intensity of the cholangitis.

Diagnosis.

If the principal symptoms are present, and if an etiological factor can be found, as a history of the passage of stones, or if it occurs during a typhoid, the **diagnosis** is not very difficult. **Perforation shows the typical signs** of any other intra-abdominal perforation, as sudden enormous exacerbation of the pain, vomiting, crossing of pulse and temperature line (see typhoid perforation), and collapse. The abdominal muscles usually become as hard as a board, preventing palpation. Fluid in the abdominal cavity can sometimes be made out after a very short while.

Differential diagnosis.

Differential diagnosis has to consider appendicitis, stones of the kidney, perforating ulcer of the stomach, and tumors of the transverse colon with symptoms of stenosis. In **appendicitis** the tumor does not follow respiration, is generally located lower down, and is usually not preceded by gall-stone attack; but if, as possible, all these symptoms are reversed, differentiation may become very difficult. **Stones of the kidney** are characterized by frequent voiding of small quantities of urine, and the presence of blood in the urine. The **ulcer of the stomach** will furnish its own peculiar history: hæmatemesis, tumor does not follow respiration, etc. **Intestinal tumors** are mostly characterized by giving practically no symptoms, or such slight signs as are out of all proportion to the size of the tumor to be felt. Especially tenderness on pressure is

nearly always absent. Peristalsis, spontaneous or on slight irritation, is characteristic.

Operation. Operation is indicated as soon as the diagnosis of empyema of the gall-bladder can be made with any certainty. If the tumor grows quickly, is tense, and very tender, if the fever is constantly high or remittent, if chills occur and jaundice is present, and the number of leucocytes is high, **operation is imperative;** especially in typhoid, as this empyema is known to incline toward perforation. If the actual **perforation has taken place** and can be diagnosed, immediate laparotomy is, of course, necessary. As in nearly all cases where pus is present, the gall-bladder has undergone such changes, especially in its loss of mucous membrane, as to be of no value as an organ, cholecystectomy is to be preferred.

Contraindication.—If cholecystitis is only a symptom of general pyæmia, operation is hardly indicated. The general contraindications for operation, as diabetes, arteriosclerosis, diseases of the lungs and heart, hold good in these cases too, unless the symptoms of the cholecystitis are very urgent. The results of the operations are generally very good, the mortality not high.

Gall-Stone Ileus.

Gall-stone ileus exists when the lumen of the intestine is obstructed by a gall-stone. The stones frequently attain the size of an egg, get into the duodenum through a fistula, and become wedged in their course, frequently in the region of the ileocæcal valve. If a slight stenosis of the gut has been pre-existent, the occlusion by a wandering stone will be more easily accomplished.

The **general symptoms** are those of ileus, which are intermittent, and the **characteristic sign** is that gas is passed with otherwise complete obstruction and even fæcal vomiting.

Diagnosis. To make the diagnosis, it is necessary to **establish** the fact that the patient has suffered from **cholelithiasis.** The ileus is usually the immediate result of an acute hepatic colic. The anamnesis must therefore show more or less frequent **attacks of colic** with vomiting, with or without jaundice; afterward sometimes passing of stones. In some cases the onset of the ileus is preceded by a very violent pain in the gall-bladder region, corresponding to the local peritonitis existing while the stone perforates.

The **symptoms of ileus** change according to the **seat of the stone.**

If the incarceration is high up, stomach symptoms prevail, as frequent vomiting, sometimes of bile, rapid loss of flesh, absence of meteorism, but complete obstruction for fæces and gas; the abdomen appears drawn in. If the obstruction is lower down in the small intestine, the vomiting soon becomes feculent. The obstruction, otherwise complete, permits passage of wind. The meteoristic loops are grouped around the navel, the sides are more flat. Sometimes the **stone can be felt** and its progress watched by patient and physician. If the stone becomes wedged in the colon, meteorism shows itself in the sides. Vomiting and collapse occur later. There is no reason to be conceived why ileus due to gall-stones should not become the object of an **operation** as soon as its presence is established, as any other kind of ileus. While it is true that gall-stone ileus is frequently milder in its course, and that foreign bodies of larger size and more uneven than gall-stones are safely passed through the intestines, any decided symptoms of ileus existing thirty-six hours, ought to lead to recommendation of immediate laparotomy, especially if the tumor is to be felt in the region of the ileocæcal valve, where a safe passage is less likely. If these cases are operated on sooner than they have been till now, the results of the operation will surely become better. Where the **mortality** is fifty-six to seventy per cent without operation, an operation with so far forty per cent mortality is surely indicated and permitted.

Location of the stone.

Operation.

Tumors of the Gall-Bladder.

Some **benign** tumor forms occur in the gall-bladder, as atheroma, fibroid, and papilloma, but they are so **rare** that it is enough to know that they do occur.

Of the **malignant** growths both sarcoma and carcinoma are met with, but the latter is so much more frequent than the former that it must suffice to describe the latter, especially as the clinical symptoms are practically the same.

The most important reason for knowing the symptoms of carcinoma of the gall-bladder as far as possible is, that it is best not to operate on carcinoma of the gall-bladder at all. This rather sweeping statement is to be understood as follows:

With our present knowledge a positive diagnosis of cancer of the gall-bladder becomes possible only after it is practically inoperable, or at least does not offer any chances of a cure. This latter is likely only if we find by chance a cancer of the gall-bladder of comparatively recent

Cancer of gall-bladder usually inoperable.

date during an operation for gall-stones, or if in future, in cases where there is only a suspicion of cancer, a small probatory laparotomy may be practised for diagnostic purposes. According to the statistics, ninety per cent of gall-bladder **carcinoma are combined with stones,** fourteen per cent of gall-stones develop cancer. These figures speak for themselves.

If in operations for gall-stones or empyema we find the wall of the gall-bladder so diseased that the organ cannot be of any value for functional purposes, the latter ought to be extirpated, for then we shall obviate a large number of carcinomas of the gall-bladder.

Differential diagnosis.

The differential diagnosis between **cholelithiasis and advanced carcinoma** of the gall-bladder and bile-passages is important in order to prevent us from operating upon cancer. The principal points are consistency of the tumor, its knobby surface, the constant icterus without intermittence, the general condition, and eventual ascites. Though the presence of stones usually is responsible for the development of cancer, the latter does not show any colic attacks such as are characteristic of stones; instead of that there are lighter, but continuous, dull pains. If acute inflammation or suppuration takes place in a carcinomatous gall-bladder, colic-like attacks are possible. In later stages involvement of the supraclavicular and infraclavicular glands (not painful) is frequent.

The **differential diagnosis from cancer of the pylorus or pancreas** is sometimes exceedingly difficult, if not impossible. If the chemical examination does not give any definite information, a Roentgen photograph might be of value, a sound filled with fine shot being introduced into the stomach.

Tumors of the Liver.

Of practical interest are those tumors of the liver whose presence we can prove by clinical symptoms. Excluding those which we know by experience to be mostly metastatic, as, for instance, carcinoma of the liver, where surgical interference cannot be thought of, we find tumors of benign and malignant character. The fibroma, adenoma, and angioma are **rare,** the gumma or syphiloma frequent. Some tumors are cystic, and then present the same symptoms as the echinococcus.

Carcinoma inoperable.

The **benign** tumors show a slow increase in size. Their principal symptoms are pressure, disturbances of the stomach, and drawing pains.

The **malignant** tumors usually show cachexia in their early stages, and metastases in other parts, such as the peritoneum, lungs, and pleura.

Syphilis frequently leads to a diffuse increase in size of the liver, and later forms lobes or even big tumors, which quite regularly disappear under antiluetic treatment. The **differential diagnosis** depends largely on the anamnesis. If the history shows a syphilitic infection, tentative antiluetic treatment is indicated. Syphilitic tumors.

All tumors of the liver, in the widest sense, have **one symptom in common,** the enlargement of the liver, which can be proved partly by palpation (of that part of the liver below the ribs) and partly by percussion.

Fluctuation is a very uncertain sign, as echinococcus, for instance, is usually under such pressure as to prevent distinct fluctuation.

Chronic abscesses sometimes show irregular fever and have usually a different anamnesis.

Indication for operative measures for liver tumor is rare. If we are able to feel a distinct tumor with a pedicle, if considerable disturbances are experienced, if all signs of a metastatic tumor are absent, an exploratory laparotomy for diagnosis, with eventual operation, appears permitted. The **prognosis** is always very grave, as the extirpation of tumors of the liver still proves very dangerous because of the profuse hemorrhage connected with it. Operation.

Echinococcus of the Liver.

The dog in his intestinal tract is the host of the tænia echinococcus. Its eggs, introduced into the intestinal tract of man, produce echinococcus of the liver.

Besides the cystic echinococcus, there is another form, the **multilocular echinococcus,** which seems to be due to a different parasite.

Only the cystic form is of surgical interest. It is frequently formed without any symptoms whatsoever. If it grows, sometimes **a palpable tumor** develops, with uniform enlargement of the liver dulness. The liver is not tender on pressure, icterus and swelling of the spleen are absent. The frequently mentioned humming of hydatids is exceedingly rare. As above mentioned, fluctuation is not frequently present; usually the tumors are very hard. Besides the fact that the tumor is palpable, **other symptoms,** which are due to pressure on neighboring organs, as dyspnœa, coughing, and palpitation of the heart, become manifest. Cystic echinococcus.

If the echinococcus suppurates, high fever, of remittent or intermittent character, with light chills, is observed. Bursting of the abscess and evacuation into other organs, and general pyæmia frequently occur. Suppuration.

If the echinococcus bursts into the lung, echinococcus cysts are sometimes coughed up. If they get into the gall-bladder or intestine, they are passed per rectum. If the echinococcus bursts into the free peritoneal cavity, severe peritonitis results.

Of **anamnestic points** careless association with dogs is important.

If the echinococcus is **subphrenic,** the sometimes bulging extension upward of the upper border of the liver is characteristic, as well as the barrel-shaped widening of the lower aperture of the thorax.

X-ray photographs may be of value.

Exploratory puncture, which would aid considerably in the diagnosis, **is absolutely forbidden.** It is criminal.

Differential diagnosis.

If the echinococcus cyst has suppurated, it is frequently impossible to differentiate it from acute abscess of the liver, except for anamnestic data. Further differential points are: **hydronephrosis** bulges out the lumbar region, is covered by the colon (proven by inflating the gut) and frequently shows considerable changes in its size. **Pancreatic cysts** lie behind the stomach after inflation of the same. In the case of **ovarian cysts,** their connection with the female genital apparatus can usually be proven by digital examination.

Operation.

Operation for echinococcus is indicated as soon as the diagnosis is probable. The operation consists in broad opening (in one or two stages) of the sac and the extirpation of the same. If the operation is executed in two sittings, there is practically no danger connected with it.

As soon as **perforation** of an echinococcus cyst is diagnosed, immediate operation is indicated. The perforation can be recognized, if a tumor, which has been recognized as such in former examinations, suddenly disappears after a trauma or excessive abdominal pressure, and if at the same time general symptoms of peritonitis develop. Very frequently an **acute eruption of urticaria** insures the diagnosis. Frequently the patients describe the sudden bursting very clearly.

The **suppuration** of an echinococcus cyst also necessitates immediate operation.

The **results** of the operation, if properly carried out (broad opening and evacuation), are practically without mortality, if done before suppuration and rupture take place.

Abscesses of the Liver.

Multiple small abscesses of the liver, in the course of diseases like septicopyæmia, usually cannot be recognized, as the clinical symptoms are hidden by those of the original disease. **Unilocular** abscesses, though, are often not very difficult to diagnose.

The principal point is not to assume an abscess of the liver, until we can possibly discover a source for the formation of pus. Important among those sources are amœbic dysentery, appendicitis, gall-stones, injury of the liver, etc.

Amœbic dysentery.

Of all the dysenteries endemic in the United States, amœbic dysentery is by far the most frequent form, and has become much more frequent since the acquisition of the Philippine Islands, though the tropics and subtropics, Cuba, etc., furnish many cases. Even in temperate regions sporadic instances occur off and on.

In all cases of assumed abscesses of the liver, careful **examination of the stools** for amœbæ and coccidia has to be carried out.

Fluctuation is usually to be felt, as the abscess is not under such great tension as the echinococcus cyst. It is more a wabbling fluctuation, as the sac has slack walls.

Exploratory puncture dangerous.

Exploratory puncture is carried out a great deal, especially by general practitioners. While it is not so dangerous as the puncture of the echinococcus cyst, which is not to be permitted under any circumstances, it has its grave dangers too. A small incision under local anæsthesia is much safer and better, which, of course, has to be followed by immediate operation if the abscess is found.

Of **general symptoms** we observe prostration, nausea, fever of remittent and intermittent type, and severe chills. The principal **local symptom** is the increase in the size of the liver, which appears intumescent, partially or *in toto*. The liver is tender on pressure, spontaneous pains in it being frequent. If the abscess is situated in the higher parts of the liver, percussion will give important information. In the later course, the chills, with supplementary profuse perspiration, become more and more frequent. In a number of cases a very circumscribed bulging and fluctuation can be observed.

If the abscess **perforates into the lung,** bright red blood is expectorated; afterward, copious pus, which is rich in hæmatoidin crystals, or which contains bile. Icterus is usually absent.

DIAGNOSIS OF DISEASES
(According

SIZE OF LIVER.		CONSISTENCY OF LIVER.			EDGE OF LIVER.			SURFACE
Shrunk.	Enlarged.	Soft to Fluctuating.	Tough, somewhat Harder than Normal.	Hard.	Smooth to Sharp.	Thick and Rounded.	Knobby, Ragged.	Smooth.
Simple atrophy. Atrophic nutmeg liver. Cirrhosis. Lues (atrophic form, quite rare). Acute yellow atrophy.	Abscess of liver. Diabetic liver. Fluxion hyperæmia. Icterus liver. Weil's disease. Fatty liver. Passive hyperæmia. Lues. Leukæmia. Connective tissue hyperplasia. Amyloid liver. Carcinoma. Echinococcus.	Fatty liver. Abscess. Echinococcus unilocularis.	Simple atrophy. Icterus liver. Hyperæmia.	Cirrhosis. Lues. Connective tissue hyperplasia. Echinococcus multilocularis (becoming soft later). Amyloid liver. Carcinoma.	Fatty liver. Icterus. Hyperplasia (sometimes slightly rounded). Echinococcus. Simple atrophy.	Fatty liver. Hyperæmia. Amyloid liver.	Cirrhosis (rarely to be felt at all). Abscess. Carcinoma. Lues.	Hyperæmia. Fatty liver. Icterus. Elephantiasis. Amyloid liver. Leukæmia. Diabetes. Acute yellow atrophy.

NOTE.—As far as possible, the diseases are arranged in the separate columns in such an order that the

If the abscess is chronic, the symptoms of general debility and cachexia become more and more pronounced.

Characteristic symptom.

A very characteristic symptom is the bending of the patients toward the right side, to relieve the tension of the right thorax. Like any other abscess, it will be indicated by **leucocytes** above 20,000. The

Localization.

presence of **peptone in the urine** is also important.

If we can prove by percussion the bulging of the liver upward, and find the diaphragm high up between the third and fourth ribs, we must assume that the abscess is right under the latter. The simple fact that the liver stands low does not indicate that the abscess is near its lower edge. This is probable only if a circumscribed bulging downward can be felt. If we find a constant point tender on pressure it usually indicates where the abscess is most superficial.

Adhesions are probable only if inflammatory œdema of the chest or abdominal wall is present.

Differential diagnosis.

For differential diagnosis the most important infection from which abscess of the liver is to be separated is the **intermittent hepatic fever** associated with gall-stones. The distinct features of this condition are paroxysms of fever, with rigors and sweats, which may occur

OF THE LIVER.

to Leube.)

OF LIVER.	ICTERUS.			ASCITES.		PAIN.	ENLARGED SPLEEN.	
Knobby.	Absent.	Rare.	Frequent.	Absent.	Present.	Present.	Absent.	Present.
Cirrhosis. Abscess. Lues. Carcinoma. Echinococcus.	Amyloid. Pylephlebitis adhæsiva. Fatty liver.	(Only if gall-passages are directly affected by the disease in: Echinococcus unilocularis. Lues.	Abscess. Hyperæmia. Cirrhosis. Carcinoma. Echinococcus multilocularis. Elephantiasis hepatis. Icterus.	Fatty liver. Elephantiasis hepatis. Icterus. Echinococcus unilocularis. Abscess.	Carcinoma. Lues with formation of scars. Echinococcus multilocularis. Cirrhosis. Pylephlebitis specifica adhæsiva. Amyloid (by the original affection). Hyperæmia (in the later stages constantly).	Echinococcus multilocularis. Acute yellow atrophy. Carcinoma. Lues. Abscess.	Carcinoma. Fatty liver.	Echinococcus unilocularis (rarely by stasis in the portal system). Hyperæmia of liver. Lues. Cirrhosis. Echinococcus multilocularis. Hypertrophic cirrhosis. Amyloid liver. Also through general infection in: Acute yellow atrophy. Abscess. Weil's disease.

respective symptoms are the more characteristic, the lower in the list the affection appears.

with great regularity, but which more often are separated by long intervals, the deepening of the jaundice after the paroxysms, the long apyrexia in the intervals, and the maintenance of the general nutrition. Besides these, enlargement of the spleen must be present. Another point, a purely malarial fever must yield to quinine.

Carcinoma in advanced stages shows intermittent fever.

For differential diagnosis metastases are of value. **Carcinoma of the stomach** should be recognized by its chemical symptoms. See the section on this subject. In **pleurisy** of the right side, percussion shows the dulness growing less toward the spine. **Echinococcus** has its slower development. **Empyema** of the gall-bladder should be recognized by the site and form of its tumor. **Hydronephrosis** and pyonephrosis show a change in size of the tumor; if it suddenly grows smaller polyuria sets in. Besides that, they both bulge out in the lumbar region, as the perinephritic abscess does also.

Operation is indicated as soon as the abscess of the liver can be made out with certainty. The exact **localization** of the abscess **by exploratory puncture** is permitted only as the first step of the operation, which has to follow at once if the diagnosis is established. Immediate operation

Operation.

is indicated if **perforation** into the chest or abdomen has taken place. The latter is recognized by the general symptoms of collapse and infection of the abdominal cavity.

The **prognosis** of the operation depends upon the time when it is done. The earlier, the better the results.

Atrophic (Alcoholic) Cirrhosis of the Liver.

It may be due, besides abuse of alcoholic drinks, to malaria and lues.

Symptoms.

The surface of the liver is uneven, the normally sharp edge of the liver thick; enlarged spleen is present. Ascites occurs sometimes early, sometimes late. Hemorrhage in the intestinal tract is a frequent, and sometimes an early symptom. Enlargement of the veins of the abdominal skin, especially around the navel, can be seen.

Operation.

The indication for surgical interference is twofold: (1) a temporary evacuation by tapping (2) a lasting relief of the pressure in the vena porta, by opening up of new vascular passages to carry off the stasis of blood. This is done by Talma's operation, securing the omentum to the anterior abdominal wall and fixation of the spleen. This latter operation is indicated even if ascites is absent or only moderate. If pronounced hemorrhages in the intestinal tract are observed, operation is contraindicated in the very last stages, as peritoneal changes may then make it impossible; and if **repeated hemorrhages** into the mucous membrane have occurred, the operation is not without **danger,** forty-four per cent having proved fatal. The operation is to be **performed** under local anæsthesia, to exclude the danger of narcosis with drinkers.

Contraindications.

Movable Liver.

In some cases the liver is displaced downward, recalling the analogous condition of movable kidney. The displaced liver can easily be made out by percussion. If it can be replaced, it is a movable liver. Sometimes the liver becomes **attached by adhesions** in its wrong place. Frequently other organs—spleen, kidneys—are displaced.

The **differential diagnosis** should be easy. Enlarged movable **kidneys** have to be excluded by intestinal percussion sound in front of them (besides the kidney tumor there is another tumor discernible, the liver).

The indication for operation is given solely by the **discomfort of the patient.** If that is pronounced enough to incapacitate the patient en-

tirely, fixation of the liver in a manner similar to fixation of the kidney is indicated.

The operation, in the hands of an experienced surgeon, is practically without danger. The results are good.

Corset or Lacing Liver.

The type of lacing liver which shows only a groove above the anterior border does not come into consideration here. We have to deal with that form where the lacing lobe is **exceedingly movable,** does not follow respiration, and is distinctly dislodged. The anterior border of (usually) the right lobe may reach to the navel line or even below. The newly formed lobe is often connected only by a thin ridge with the rest of the liver, so that intestinal loops may lie between the two, and thus make it difficult to prove that they belong together.

Anatomical form and site.

Usually the corset liver gives few or **no symptoms;** even if acute inflammation sets in, conservative treatment is indicated, as it usually subsides.

In those rare cases in which the discomfort becomes so great that the **operation** is desired, it is permissible. It consists either of ventrofixation or of resection of the lobe; the latter is, of course, much more dangerous on account of the possible hemorrhage.

INJURIES AND DISEASES OF THE SPLEEN.

INJURIES OF THE SPLEEN.

Injuries of the spleen are either subcutaneous or penetrating wounds.

Rupture.

The subcutaneous injuries are principally rupture of the spleen. It is doubtful if a normal spleen can be ruptured. Usually the affected organ is **diseased** by malaria, typhoid, or recurrent fever. Only by severe **trauma,** being run over, a kick by a horse, etc., may a normal spleen be ruptured. Perforating **wounds** by shot, cut, or thrust, are **rare.** Subcutaneous rupture may be effected by **violent contractions** of the abdominal muscles and the diaphragm, as violent sneezing, coughing, vomiting. In **cachectic individuals** simple palpation of a splenic tumor has resulted in rupture of the organ, a fact which should call for care in such examinations. Apparently **spontaneous ruptures** have taken place during pregnancy.

Of **operative injuries** a case is well known, where exploratory puncture of the spleen for supposed echinococcus resulted in a fatal hemorrhage.

Hemorrhage.

Rupture of the spleen is **characterized by the symptom** of internal hemorrhage, which overshadows all other symptoms. The hemorrhage is indicated by the usual signs: sudden pallor, small, exceedingly frequent pulse, cold extremities, restlessness of the patients who feel cold and faint. **Other general symptoms** are shortness of breath, palpitation of the heart, hoarseness, which may increase to complete aphonia. All these symptoms are **brought about by pressure on the vagus. Locally,** we find either the entire abdomen filled with blood (distention, dulness, tense fluctuation), or the hæmatoma is localized to a certain part of the abdomen, if previous inflammatory processes have formed adhesions.

If the capsule is intact, or torn only to a small extent, the quickly increasing **tumor of the spleen** can be made out.

As there are no specific symptoms of rupture of the spleen, we must be satisfied with the **diagnosis** of an intra-abdominal severe hemorrhage (hemorrhagia interna). The obviously necessary laparotomy will reveal the nature of the rupture.

Penetrating wounds of the spleen are recognized by the site of the wound leading to that organ, and the manner of the hemorrhage, which is exceedingly profuse. In a comparatively large number of cases of abdominal penetrating wounds the **spleen has prolapsed** into the wound. Frequently we then find a striking disproportion between the size of the wound and that of the prolapsed part of the spleen. This is due, to a great extent, to the swelling brought about by the incarceration. This same swelling usually stops the hemorrhage. Penetrating wounds.

The **prognosis** of rupture of the spleen is **very bad.** In about forty per cent it ended fatally. It may be mentioned that in cases of rupture of the spleen by trauma (boxing), an anterior tear in the organ is frequently accompanied by another tear at the posterior surface; therefore quick extirpation seems more advisable than conservative operative treatment.

TUMORS AND HYPERTROPHIES OF THE SPLEEN.

The tumors of the spleen are either cystic or solid.

Of the cystic form, echinococcus cyst is by far the most frequent. The tumor can usually be made out exactly without any trouble by palpation and percussion. Fluctuation can be found in nearly all cases. Echinococcus.

The **differential diagnosis** from left side **hydronephrosis** can be established by inflation of the colon, cystoscopic examination of the discharge of the left ureter, exact anamnesis, and examination of the blood. The **diagnosis** becomes probable if the tumor grows very slowly and exists for years without any general symptoms, which appear only after the tumor begins to exert pressure on neighboring organs.

Exploratory puncture is absolutely forbidden.

If the diagnosis of echinococcus of the spleen has been made, **broad incision** of the echinococcus sac is indicated to prevent suppuration and rupture, which have always proved fatal. The **mortality** of the operation is about twenty per cent.

The **solid** tumors are all exceedingly **rare,** except the primary sarcoma of the spleen, which has been observed in a number of cases. The **symptoms** are rapid growth of the spleen to a tumor of uneven, knobby surface, with pronounced tenderness. If these symptoms are present, in the absence of any blood changes or of the history of malarial infection, **probatory incision** is justified for final diagnosis. Sarcoma.

By far more important are the chronic hyperplasias of the spleen.

Chronic hyperplasia.

To whatever causes the chronic hyperplasias of the spleen may be due, they do not furnish any characteristic symptoms except the **swelling of the organ.** We therefore first have to ascertain if the tumor, which can be felt, really belongs to the spleen.

Differential diagnosis from other possible abdominal tumors is not very difficult. The **site and direction** of the long axis of the organ differentiate it from tumors of the kidney, gut, and other abdominal viscera.

Anatomical site of tumor.

The splenic tumor originates in the left hypochondrium, and its axis points diagonally downward toward the crista ilii. Its surface can be readily followed, starting from the pelvis, upward to the ribs, where the upper pole disappears and can never be grasped, except when we have to deal with a movable spleen. In deep inspiration the spleen goes far down. The lower point of the organ is a blunt point, easily grasped. Indentations of the edge are rarely to be felt.

Differential diagnosis.

In the differential diagnosis, **carcinoma of the stomach** and pathological conditions of the **left lobe of the liver** come into consideration. Carcinoma of the **stomach** can usually be made out by palpation, even if the tumor is high up.

In tumor of the **spleen** the upper end of the tumor can never be reached.

In tumors of the **liver** the free edge of the liver moves straight down in deep inspiration, the spleen more obliquely. In tumor of the liver the continuity of the free edge proves that the tumor belongs to the liver.

After the establishment of the fact that the tumor belongs to the spleen, the **pathological form** has to be decided on.

Causes.

Hyperplasia of the spleen may be due to pseudoleukæmia, to simple hypertrophies, to malaria, to amyloid disease, to tuberculosis, and to actinomycosis. Of all these tumors only the **malarial spleen should be operated upon,** *i.e.*, by splenectomy.

The **attempt to cure leukæmia** by extirpation of the spleen is unphysiological and besides nearly necessarily **fatal** (ninety-eight per cent of operated cases have died of hemorrhage).

The **operative treatment of malaria** serves two purposes, after quinine and arsenic have proved without any further value. First, we want to remove the spleen as a reservoir of toxic elements and plasmodia. Secondly, we want to remove the tumor to relieve the symptoms of pressure on neighboring organs. It is of great importance to find out **if the spleen is movable.** If so, its extirpation gives much better results.

Mortality.

Of twenty-six cases only one patient died, the other twenty-five were cured. In cases in which it was immovable, the mortality was twenty-seven per cent.

In **idiopathic hypertrophy** (without known cause, especially in women between thirty and forty) there was a mortality of thirteen per cent following extirpation. **Splenectomy is absolutely indicated** if the malignity of the tumor can be made out, or echinococcus diagnosticated.

Banti's Disease.

Banti describes the three stages of the disease as follows:

1st. **The stage of primary enlargement** of the spleen with anæmia. The hypertrophy of the organ develops slowly until the tumor is very large and dense, with a smooth surface. At the same time all the **clinical symptoms of anæmia** (palpitation, tired feeling, œdema of the legs, epistaxis) develop more and more, but not necessarily parallel with the changes in the spleen. Oligocythæmia, and oligochromæmia, and decrease in the number of leucocytes are observed. No fever, no swelling of glands, normal urine, no ascites. This stage lasts usually three to five years, sometimes up to ten.

2d. **The intermediate stage.** It is characterized by decrease in the quantity of urine, by the presence of urobilin in the urine, by icterus of skin and mucous membrane, and by intestinal disorders. This lasts for several months.

3d. **The last stage** show secondary cirrhosis, with ascites. In this stage, fever occurs in the evening and the symptoms of anæmia, icterus, hemorrhagic diathesis, develop more and more. **Death follows,** usually not later than one year after the beginning of the third stage.

For the differential diagnosis we have to prove that all other etiological factors of a spleen tumor are absent. During the course of the disease the diagnosis becomes possible. Differential diagnosis.

Operation (extirpation) is indicated if the size of the tumor creates serious local disturbances, or if the tumor of the spleen shows a tendency toward torsion of the pedicle or toward movable spleen. **In later stages** the operation is relatively indicated, if the patients become incapacitated for work and are seriously hindered in their enjoyment of life. As long as the disease is as little known as now, **early operations are not indicated.** If possible, it should be ascertained before the operation if the spleen is freely movable, as **dense adhesions contraindicate** the

operation. Even if the former favorable condition exists, the **mortality** of the operation is twenty-three per cent, which, after all, is not very high compared with the absolutely **fatal prognosis of the disease without operation.**

Movable Spleen.

If the spleen becomes movable by stretching of the gastro-lienal ligament and of the vessels, it usually can be diagnosed easily as such. At the normal place of the spleen, between the ninth and eleventh ribs, we find tympany, which changes to dulness as soon as the displaced spleen is put back in its proper site. The movable organ is usually easily felt under the left hypochondrium, sometimes still lower down, even in the small pelvis. The tumor has the typical oval form of the spleen. Sometimes the edge can be felt, as well as the pulsation of the artery.

Site of the tumor.

The **symptoms** are very variable. Sometimes the affection is borne without any discomfort at all. In other cases indistinct symptoms, as feeling of heaviness, nausea, dyspepsia, headaches, neuralgic affections, and even paresis of the legs are experienced. Sometimes general enteroptosis is observed.

Differential diagnosis.

In the differential diagnosis we have to exclude **movable kidney** and **ovarian tumors.** If the movable tumor felt in the abdomen is not the spleen, the latter can be found in its normal place. We have to convince ourselves if the kidneys are where they belong, and the differentiation may become difficult only if both kidney and spleen are movable.

In some cases it has been possible to make the **diagnosis of torsion** of the pedicle of the spleen by the symptoms of **internal incarceration,** such as sudden very violent attacks of pain, rapid increase of the splenic tumor with pronounced tenderness, beginning peritonitic symptoms, and collapse.

Indication for Operation.—As only enlarged spleens become movable, one should try by internal treatment to reduce the size of the spleen. After this has failed and symptoms appear which indicate either pressure on other organs or tendency toward torsion, extirpation or fixation of the spleen is indicated. If the tumors are exceedingly large, the danger of extirpation increases very much. The **mortality** is eighteen and a half per cent; the results of the operation are good. Operation is strictly indicated only if torsion of the pedicle has occurred.

Amyloid Spleen.

The **very uncertain diagnosis** of amyloid disease of the spleen can be made with some probability only after long-existing suppuration, tuberculosis of the bones or the lungs, or syphilis of very long standing, and when **other organs** show also symptoms of amyloid degeneration. If this is the case, surgical interference would be hardly of any value, as it would not have any influence on the amyloid degeneration of the other organs.

Abscess of the Spleen.

If **thrombosis or embolism** of the spleen occurs, and the plug is charged with infective virus, abscess of the spleen is the result. Besides these etiological factors, **recurrent fever and typhoid** may be responsible for this condition.

The **symptoms** of abscess are those of a sudden tumor of the spleen, combined with the clinical characteristics of an internal abscess, as leucocytosis above 20,000, fever with irregular intermissions and chills, high pulse, general septic condition and expression of the patient. If the tumor shows fluctuation, **exploratory puncture** (which may have to be followed at once by laparotomy) may define the diagnosis.

Operation on the abscess (incision) is indicated as soon as the diagnosis of abscess of the spleen can be made, and should not be carried out only if there is reason to assume the presence of **multiple abscesses** in other organs.

INJURIES AND DISEASES OF THE PANCREAS.

INJURIES OF THE PANCREAS.

The injuries of the pancreas are usually combined with injuries of other organs, as stomach, intestine, liver, etc. **Wounds** of the pancreas are **extremely rare,** and always combined with other wounds. Most of the patients die. The **subcutaneous injuries** of the pancreas by blows, kicks, falls, etc., are of interest only in so far as they frequently lead to **formation of cysts** later on, if the patients survive the injury.

DISEASES OF THE PANCREAS.

The diseases of the pancreas, though not very frequent, are of great clinical interest.

Pancreatitis (inflammation of the pancreas) may be acute, subacute, or chronic.

Acute inflammation.

The acute form is **rare, but characteristic.** Fat people have a predisposition to it. Otherwise strong, healthy men of middle age are suddenly stricken sick with violent pains in the epigastric region, vomiting, and symptoms of peritonitis. Meteorism quickly follows, and paresis of the intestines. The pulse is small and frequent, and the patient in collapse. Fever may be absent. Most of these cases end **fatally** within a few days.

Chronic form.

If this is not the case, the disease finally assumes a more chronic character. **Remittent fever** sets in, and an **infiltration** in the epigastrium can be felt, which is behind stomach and colon (to be proven by inflation of these two organs). **Obstipation** is complete, until in the later stages diarrhœa may follow. Examination of the **fæces** shows the presence of fat (steatorrhœa) which, if present, is one of the most **characteristic symptoms** of disease of the pancreas, if we can exclude an affection of the liver or intestine. Besides this, **diabetes** is one of the principal important symptoms. While its absence does not speak against disease of the pancreas, its presence is of value if other symptoms are to be found.

Impaired digestion of albumin, azotorrhœa, is also of value, but only if combined with diabetes, if a tumor is palpable in the pancreatic region, and if diseases of stomach and intestines can be excluded. The **skin** sometimes shows a specific grayish-brown bronze color. **Icterus** is quite frequent, especially in the chronic forms. In the latter case the enlarged head of the pancreas is quite often felt as a hard **tumor.**

Diagnosis. The **diagnosis is exceedingly difficult.** Acute cases with violent symptoms have often been mistaken for internal occlusion or perforative peritonitis, and the right diagnosis was not made until during the operation. The more chronic forms give more chance for a probable diagnosis. The head of the pancreas, as mentioned above, becomes exceedingly hard and gives on palpation the feel of a knobby, hard tumor, according to its structure. Therefore these inflammatory tumors have frequently been mistaken for carcinoma of the pancreas, even during operation.

As the much disputed and described **fat necrosis,** due to affections of the pancreas, is of no real practical value from a surgical standpoint, it may be omitted here. If **necrosis** of the pancreas is the **result of inflammation,** or of hemorrhages into the pancreas, it is not of such importance, as the differentiation is clinically not possible. Necrosis of the pancreas, if it can be diagnosed, will appear under the clinical picture of acute or subacute inflammation.

Operation. The indication for operation is not absolute in acute cases, but as the **prognosis without operation is exceedingly infaust,** the **mortality** of forty per cent in operations for acute pancreatitis is not discouraging. In the chronic form the results of the operation are rather encouraging, the mortality being thirteen per cent.

Calculi of the Pancreas.

Pancreas-stones are most frequent in men between thirty-five and forty-five. Usually there are several stones. Sometimes the ductus wirsungianus is encrusted. The stones are frequently situated near the opening into the duodenum. They may reach the size of a cherry-stone, and usually consist of calcium phosphate or carbonate.

Diagnosis. As the stones usually give few or no symptoms by themselves, the diagnosis usually rests on the **symptoms of pancreatitis,** and the stones are found by chance during operation. Exceptional are those cases in which pancreas-stones are passed in the stools, and the diagnosis is thus

made. Besides this, stones may give rise to **violent colics,** similar to those of gall-stones. The pain is situated in the region of the stomach, and frequently radiates toward the left. A **characteristic sign** of the accompanying inflammation of the pancreas is ptyalism (exaggerated salivation), diarrhœa in which large masses of undigested meat fibres (azotorrhœa) and abnormal quantities of unabsorbed fat (steatorrhœa) are passed, and diabetes. **Icterus** may accompany the attack, therefore the **differential diagnosis** between gall-stones and pancreas-stones should never rest on this point, the more so as in gall-stones icterus is present in only about twenty per cent of the cases. Fever is comparatively rare.

The diagnosis rests on the symptoms described, but will be possible only in exceptional cases.

Operation. The indication for operative interference is given by the inflammatory palpable tumor in the region of the pancreas, and very pronounced disturbances.

There are as yet no reliable statistics of the **prognosis** of these operations, but they usually belong to the most serious type.

Pancreatic Cysts.

If the **general symptoms of pancreatitis** are present, and we **feel a tumor** in the pancreas region, of smooth surface and soft fluctuating consistency, we must think of a **pancreatic cyst.** The **size** of the tumor may reach that of a child's head or larger, and may fill the entire abdominal cavity. The **cyst is situated between liver and spleen,** and usually pushes the stomach upward and the colon downward, which can be demonstrated if these two organs are inflated. The striking, quickly progressing **cachexia** and the **periodical colics are characteristic.**

Differential diagnosis. The differential diagnosis has to consider echinococcus of the abdominal organs, ovarian cysts, and hydronephrosis. The pancreas cysts start from the epigastrium, while other cysts do not. **Liver cysts** are never covered by the inflated stomach. An enlarged **gall-bladder** has hardly ever the colon before it, nor does this happen in **spleen** cysts. In big **ovarian** cysts, which reach high up, the uterus is drawn up too. **Hydronephrosis** does not start in the epigastrium, and bulges out in the lumbar region if the colon is inflated. Steatorrhœa need not be present in all cases, because the cysts are usually situated in the body and cauda of the pancreas, and thus do not interrupt entirely the secretion of the organ and its delivery into the gut.

Exploratory puncture is not permitted, except during laparotomy, although it might aid materially in the differential diagnosis. If the diagnosis of pancreatic cyst has been made, **broad opening** of the cyst is indicated, in either one or two sittings. Puncture and evacuation of the cyst through the abdominal wall has been fatal in nearly all cases. Operation.

Results of the Operation.—The drainage of the cyst shows a **mortality** of five per cent, extirpation eighteen per cent. If rupture of the sac has been diagnosed, immediate laparotomy is, of course, indicated, but probably will in most cases be of no avail. It is more important to prevent the perforation by earlier operation.

Tumors of the Pancreas.

By far the most frequent neoplasm of the pancreas is **carcinoma.** Others, as adenoma, sarcoma, tubercle, and gumma, are so rare that they need only be mentioned.

Primary carcinoma of the pancreas is usually **situated in its head,** thus producing an occlusion of the pancreatic duct, or compressing the choledochus duct. All symptoms, which have been considered on and off as characteristic for carcinoma of the pancreas, have proven fallacious. Only **palpation shows the presence of a tumor** in the region where the pancreas belongs. If it is possible, for other reasons, to exclude a growth in any other organ, the diagnosis of carcinoma of the pancreas is justified. In lean persons it is possible sometimes to feel the head of the normal pancreas through the pylorus and the transverse colon. Tumors of the pancreas may therefore be felt, as the growth not only enlarges and hardens the organ, but emaciates the patient at the same time. Carcinoma.

The diagnosis of tumor of the pancreas is exceedingly difficult until the growth is big enough to be felt. Of the **general symptoms** those supposed to be characteristic of the affections of the pancreas, as diabetes, steatorrhœa, etc., are useless, as these symptoms occur only when the organ is affected in its entirety, so that surgical interference is useless if the symptoms are present. Only carcinomas of the pancreas in their early stages ought to be operated upon. If a **tumor can be felt in the epigastrium,** which does not follow the stomach if moved, and if **jaundice** is present with an enlarged gall-bladder, **while symptoms of gall-stones are absent,** the diagnosis of a pancreatic tumor is probable. Diagnosis.

For **differential diagnosis** it has to be remembered that the gall-

bladder is usually shrunk if the choledochus duct is occluded by a stone, thus producing icterus; tumors of the stomach can usually be differentiated by their influence on the chemical action of that organ.

Tumors of the colon can be made out by inflation of the stomach and the gut (pancreatic tumors are shown by inflation to lie usually between stomach and transverse colon).

Indication for extirpation.

The indication for radical extirpation of the carcinomatous tumor of the pancreas is uncertain. If the tumor has developed too far, its extirpation is impossible, and even in cases in which the tumor involves only the head of the pancreas, total **extirpation of the organ is contraindicated,** as even in those cases it is always followed by diabetes. In many cases only probatory laparotomy will give the exact differential diagnosis, as well as the indication how far to go with extirpation. One of the gravest **dangers** of the operation is **parenchymatous bleeding.** This danger is increased enormously if jaundice has been existing for any length of time. Another danger is **gangrene of the colon,** for which reason the arteria mesenterica superior with its vein must be saved.

INJURIES AND DISEASES OF THE KIDNEYS AND URETERS.

The Examination of the Kidneys.

The examination of the kidneys is difficult, because of their anatomical situation. The topographical conditions vary considerably in different individuals.

The form and the length of the twelfth rib, which normally covers the kidney in a diagonal direction, differ so much as to leave in some cases more than two-thirds of the kidneys uncovered (and unprotected at the same time), while in others the ribs are so broad and stiff, and reach so far downward as seriously to interfere with examination (and operation). The **examination of the kidneys** consists, like all other examinations, of inspection and palpation. If the kidney is displaced or enlarged, or both, we can frequently see a distinct **bulging in the lumbar region,** if we bring the patient in the proper situation and light.

Differences in twelfth rib.

The **inspection** has to be done from in front, as well as from the back. The patient should bend forward over the edge of the table, and we inspect the back by standing at the head of the patient, looking toward his sacrum. Any bulging will then appear more plainly than if we look at the patient standing.

Palpation shows much more. It is done with both hands in different positions. It is a very common mistake to place patients to be examined flat on their backs with outstretched legs and only the head supported by a small pillow. In this position the kidney usually goes as far up as possible; it will therefore show no displacement, if present, nor tumors. The patient is best put in **dorsal position,** propped high up by supporting cushions, the knees slightly drawn up. In this position the **kidney will come down** as far as possible, and the abdominal walls will be relaxed. Next best is the standing position, the examining physician sitting on a chair, the patient standing before him; here the kidney will also descend, but the abdominal wall is stiffer. In other cases the patient is placed with advantage on his sound side, with the knees slightly

Position of patient.

drawn up; the examiner then stands facing the patient. This position has the advantage that the intestines do not overlie the kidney. Palpation is then carried out in the following manner:

Method of palpation.

To examine the **right kidney,** we stand on the right side of the patient facing him, the left hand is applied to the lumbar region and the right hand on the abdomen. The patient is requested to breathe quietly but deeply, at each respiration the right hand tries to advance deeper. All undue pressure has to be avoided, as it immediately causes reflexes, stiffening the muscles. If the kidney cannot be felt in this position (as all normal kidneys), the right hand tries to work upward under the arch of the ribs, the left hand shoves the organ upward (in sagittal direction) toward the other hand, and produces what is known as **ballottement,** tossing the organ between the two examining hands like a ball. The palpation is the more successful, the better the patient understands how to relax his abdominal muscles. If he does not know how to do this at all, or if the patient is too fat, **narcosis** sometimes becomes necessary for the purpose of examination.

What palpation reveals.

This palpation will reveal, first, **abnormal position** of the kidney and its **movability,** then **enlargement** of size, which may be due to hydronephrosis, tuberculosis, or tumors. As the right kidney lies with its upper two-thirds against the liver, any increase in size will push the kidney downward, where we can feel it; but **in case of enlargement it is not movable** (unless it is a movable kidney besides, which is very rare). On the contrary, these kidneys usually become very adherent at their displaced situation.

We have now to **decide if the tumor** felt **belongs to the kidney,** or if it may be a part of the liver, or corset liver, etc.

Colon and kidney.

The relation of the colon to the tumor is of great importance. To be able to diagnose the pathological conditions, it is necessary to be conversant with the normal relative situation of these two organs. The **colon covers the lower third of the right kidney,** and then reaches to the left in an upward concave curve to the upper pole of the **left kidney, covering its upper third,** and descending with its inner line outside of the outer edge of the kidney. Of course, these conditions vary greatly, especially in women who are affected with enteroptosis (Glenard's disease); then, inflation of the colon for differential diagnosis, whether a tumor belongs to the kidney (when it ought to be pressed backward) or to the right lobe of the liver, is without any value.

On the left side, the spleen may cause differential diagnostic difficul-

ties, but it can be made out more easily by its **sharp lower edge and its notches.**

Sometimes a **stone in the pelvis** can be felt as a small hard tumor, corresponding to the site of the pelvis of the kidney. If there are several stones, they may produce crepitation. **An enlargement, with irregular knobby surface of dense consistency, speaks for malignant tumor;** if Stones.

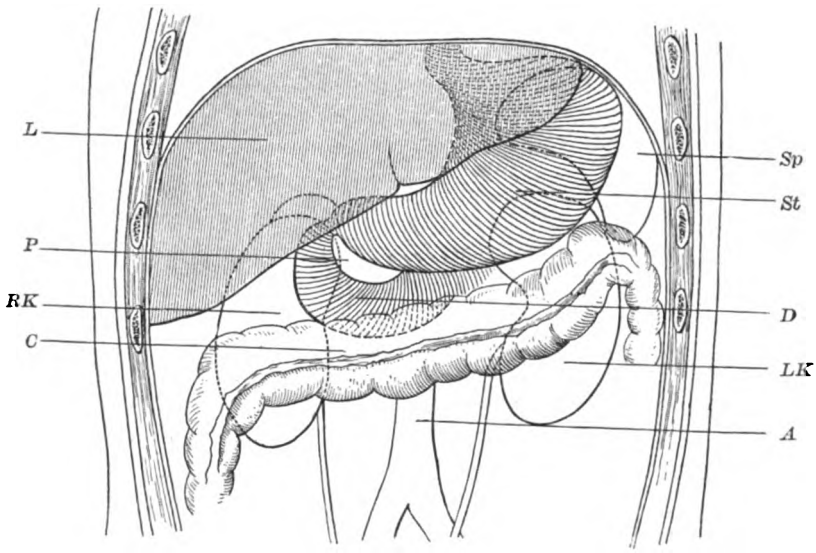


FIG. 18.—Topography of the Abdominal Organs. Note the relative position of transverse colon and right and left kidney. *L*, liver; *P*, head of pancreas; *LK*, left kidney; *C*, transverse colon; *Sp*, spleen; *St*, stomach; *D*, duodenum; *RK*, right kidney; *A*, descending aorta.

the surface is smooth and the tumor more spheric, we have to deal with an adenoma or a cystic tumor (hydronephrosis, pyonephrosis, or echinococcus).

Fluctuation (not easy to be felt) speaks for a cystic formation or a very soft tumor. If the cyst is filled to its utmost, fluctuation cannot be felt and even the cystic character may not be recognized.

Percussion is practically without value, possibly it may have some result if the colon is inflated.

Exploratory puncture is forbidden.

Roentgen pictures may be of value. Lately many stones have thus been found.

Of the highest value is the **examination of the urine.** Albumin, cylinders, blood, and pus are of importance if their origin can be rightly Urine.

recognized. But it is not sufficient to determine whether the abnormal contents of the urine are of renal origin, or not. It is, on the contrary, **absolutely necessary to determine from which kidney** it comes, or if **both kidneys** are affected. This is effected by **cystoscopy and catheterization of the ureters.** This latter procedure is comparatively easy in women.

Catheterization in women.

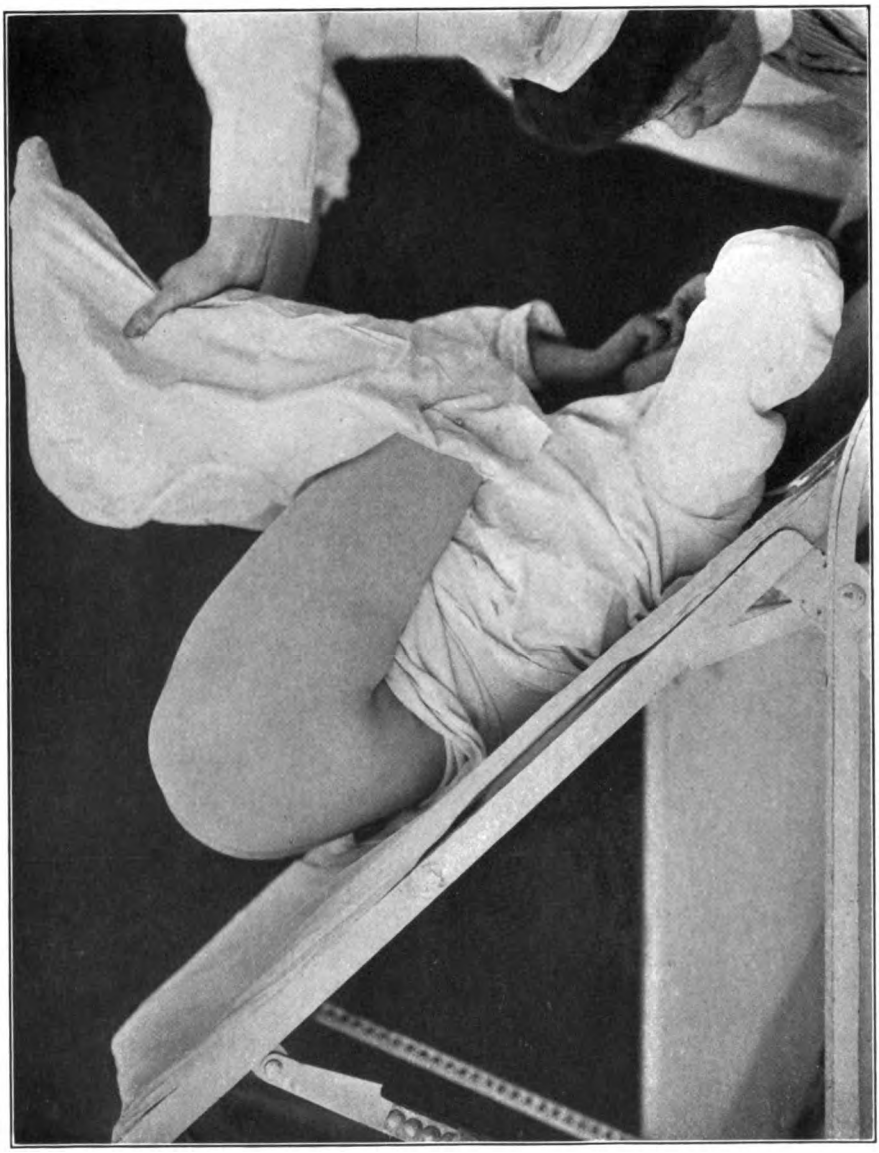
Pryor's Method is by far the most satisfactory. The patient is put in an exaggerated Trendelenburg position, and the thighs are drawn up to the abdomen. The bladder, washed out beforehand and emptied, aspirates air through the introduced tube, and the **entrance of the ureter** can be detected at once. The catheterization of both ureters can easily be done in two minutes. In many patients **narcosis** is advisable. When the catheters are introduced, the patient is put back in the horizontal position, and the end of the catheter led into a test-tube, which is lightly closed with cotton. The test-tube is fastened to the respective thigh by an adhesive-plaster strip. The urine sometimes does not flow until ten minutes after introduction—the result of the position. The flow is carefully watched, and the test-tubes, with the catheters, are removed after enough urine is collected. The **relative quantity** discharged in a given time is frequently of great importance. **The urine of each kidney is then examined separately** by microscope and chemical action, and this gives us most valuable information as to the condition of both kidneys. Frequently it is a question of extirpation of one kidney, which is, of course, feasible only if the other one is healthy, so as to be able to support life by doing the work of both.

Catheterization in men.

In men the catheterization of the ureters is much more difficult, and a great many instruments have been devised for this purpose. The only satisfactory instruments so far are those of Casper and of Albarran. For a description of their construction and use the reader is referred to the respective publications.

But these instruments are of value only in experienced hands. It is necessary to command the **technique of general cystoscopy,** to be able to use the instruments with advantage. Even then most of these patients have to be anæsthetized for examination. There is another disadvantage connected with this method of gaining the urine of each kidney separately by catheterization of the ureters, and that is, that many patients react with a **high temperature,** up to 104°, even if no infection has taken place. Besides this, **catheterization of the ureters is strictly contraindicated in tuberculosis of the bladder,** or if the same is suspected.

Disadvantages of these methods.



PRYOR'S POSITION
for cystoscopy and catheterization of ureters in women.

For all these reasons mentioned, other attempts have been made to gain the urine of each kidney separately, the most successful of which is Harris's method, where a ridge of the bladder is formed in the mesial line by the introduction of a peculiarly formed lever into the vagina or rectum. Thus **two pockets are formed** in the bladder, each of which is filled with urine from the respective ureter, which is aspirated into a separate vessel by a suction-pump.

Surgical interference for the same purpose.

If all these methods, for some reason or other, do not succeed, others may be applied, as, first, **introduction of the ureter-catheters from the bladder** by epicystotomy; second, an **incision into one kidney** and the introduction of a catheter into the pelvis of the kidney through the organ. The urine of the other kidney is then obtained from the bladder.

For further diagnostic information both kidneys may be exposed by a **lumbar incision** and most changes can thus be seen and felt. The latter method is, of course, a serious operation in itself.

Besides the chemical examination of the urine, **cryoscopy** has lately proved of immense value. As it is impossible to describe the method here in detail, it must suffice to say that the **determination of the freezing-point of the urine and the blood** gives certain figures, which appear to be quite exact, so that we are able to determine if a kidney is sound, or sound enough, at least, to take the work entirely or partially of the other diseased kidney.

INJURIES OF THE KIDNEYS.

Injuries of the kidneys are comparatively rare, by reason of their protected situation.

Injuries of the Kidneys Without External Wound.

Various causes.

The mechanism of these injuries varies greatly. In some cases **direct blunt force** is responsible, as in the case mentioned in the Introduction, where a passenger standing on the rear platform of a street-car was hit in the lumbar region by the knob of the brake-handle as soon as the grip-man disengaged the brake-chain; or the injury may be **self-inflicted,** so to speak, by simple muscular exertion, as lifting heavy loads, jumping, wrestling, etc. One injury, which has been recognized comparatively recently, is compression of the kidney between the **free edge**

of the rib and the spine. Besides these direct influences of force, other agencies are responsible for injuries, especially where the kidneys burst by **hydraulic pressure.**

Tissues affected.

The injury may engage all the tissues of the kidney, including the fat capsule and proper capsule, or may consist in contusions, or deep tears, or complete crushing of the parenchyma.

It is hardly necessary to say that in many cases the force which brought about the injury to the kidney may also cause fractures of the ribs, tearing of the peritoneum, and injuries of the intestine, liver, or spleen, thus heightening the danger by these complications.

Symptoms.

The first and most striking symptoms are those of **deep collapse or severe shock,** which may last for hours or even days. According to the degree of the injury, the **pain** is either very severe at once, or first light, then increasing. The pain is usually due to pressure on the kidney by intracapsular or pericapsular **hemorrhage,** but even in cases in which only slight peritoneal hemorrhage has been found on operation, the shock, as well as the pain, may be very intense. Both these symptoms are explained by **pressure on the solar plexus.** Besides this, other **nerves,** such as the ilio-inguinal and genitocrural, may be affected.

After these symptoms, the next in importance in **hæmaturia.** This is present, of course, only if the tear in the kidney reaches into the pelvis; and on the other hand, it may not appear, in spite of serious destruction of the kidney and hemorrhage, if **the ureter is torn.** If the hemorrhage is abundant and the ureter permeable, the blood flows quickly into the bladder, which was not empty before, and therefore very soon great distention of this viscus results. When the patient urinates, he is frightened by the appearance of bright red blood. If no hæmaturia is apparent, it may be very difficult to differentiate the symptoms of shock from those of internal hemorrhage.

Illustrative case.

A hospital nurse, in lifting a patient, felt a severe, sudden pain which subsided about an hour after. She kept on with her work for twenty-four hours, then she reported sick, in which time she urinated only once, 400 c.c. In the next twenty-four hours she passed 300 c.c. She felt comparatively well, with the exception of sometimes severe twitching pain in the lumbar region. After forty-eight hours she showed sudden symptoms, which were

construed as those of internal hemorrhage—rapid, small pulse, 160 and more, pale face, cold nose, cold extremities, a queer feeling on the injured side, extreme restlessness, and shallow breathing (air-hunger). After injection of camphor, she was placed on the operating-table, where, just before being operated on, she developed tonic spasms in both hands and arms, with anæsthesia of the cornea and mucous membrane of the pharynx, resembling an hysterical attack. The operation was postponed, and the shock lasted for several hours. Exposure of the kidney a week later showed a parenchymatous subcapsular hemorrhage on the posterior surface of the kidney, about two inches long and a half inch wide. The symptoms were clearly elicited by traumatic shock to the solar plexus.

Does blood in the urine proceed from bladder or kidney?

To determine whether blood passed from the bladder, has its origin from a hemorrhage of the bladder, or comes from the kidney, we have to remember that in a **kidney hemorrhage the urine is equally bloody** through the entire micturition, while a **hemorrhage from the bladder shows most blood at the end** of it. Besides this, hemorrhage of the kidney produces blood cylinders, which are casts of the ureter. Cystoscopy, though much recommended, is of very little use for this determination, as the presence of blood and its flow make it impossible to see anything with this instrument.

The injured kidney produces very little urine, and even that is sometimes not passed into the bladder, therefore we notice **anuria or oliguria.** Another symptom is **reflex anuria,** where the sound kidney, which so frequently takes the work of two kidneys if one is diseased, now on the contrary refuses to secrete.

If the peritoneum is injured as well, acute putrid peritonitis is the result. If the injured kidney is not removed and the patient lives, acute infection and suppuration of the kidney may take place, descend into the bladder and then, ascending, affect the other kidney.

How to ascertain these symptoms.

All these symptoms mentioned will be brought out by **careful palpation** of the kidney region, if necessary under anæsthesia, by **exploratory puncture** (which is permissible only as the first step of a further operation), **frequent examination** of the quality and quantity of the **discharged urine,** observation of the general condition of the patient, temperature, pulse, etc.

The **prognosis** of injury of the kidney is expressed by thirty per cent mortality. The early and exact recognition of the injury, as well as its extent, is of the highest importance to insure prompt operation.

Open (Compound) Injuries of the Kidney.

These are still rarer than the injuries by blunt force, and usually present no difficulty in diagnosis. The **direction of the wound** passage will usually lead to the injured organ. Severe hemorrhage, and especially eventual **discharge of urine** through the wound, make the diagnosis sure.

Prolapse of kidney into wound.

One characteristic of wounds connected with kidneys is the prolapse of the organ into the wound, similar to what occurs in injuries of the spleen, as above described. Any large penetrating lumbar wound is liable to be complicated by a prolapse of the kidney. The kidney may come out of the wound in its entirety and then swell up and become dark blue, when **thrombosis** may ensue and finally **gangrene,** if the organ is not replaced.

Simple wounds of the kidney heal remarkably well, as we know from operations. Eventual **complications,** especially in shot and stab wounds, have to be looked for; such are opening into the pleura, etc.

Gunshot wounds of the kidney are usually fatal, as other neighboring organs are injured at the same time.

DISEASES OF THE KIDNEYS.

Acute Nephritis.

Acute Bright's disease may become the object of surgical interest. For diagnosis cf. handbooks of internal diseases. It may suffice to say that it is often not accompanied by fever; **pain,** spontaneous and on pressure, is frequent. The quantity of **urine** is usually diminished, its color that of dish-gravy, of high specific gravity, with much albumin, blood, and granular cylinders. Pronounced **hydrops** is frequently present, but not necessarily so. **Hypertrophy of the heart** is, in the later stages, usual. Often anæmia develops.

Chronic parenchymatous nephritis is characterized by urine of nearly normal quantity, with much albumin and blood, and practically normal specific gravity. Hypertrophy of the left ventricle is regular. Ophthalmoscopy shows retinitis albuminurica.

Unilateral form.

There is another form, which seems to be unilateral and therefore of great surgical interest. In these cases albuminuria is frequently lacking, as well as cylinders, and it is to be **recognized by its attacks of colic and hemorrhages.** Stone in the kidney has to be excluded.

In secondary and genuine **contracted kidney** (renal cirrhosis), the pulse is of high tension, and the hypertrophy of the left ventricle is highly developed. The **urine** is copious, of light color, lowest specific gravity, with little albumin and casts. Hemorrhage of the brain and severe œdema are frequent.

If acute nephritis shows pronounced oliguria or complete anuria with violent pain, spontaneous and on pressure, of one or both kidneys, operative interference is justified. The operation consists in **nephrolysis,** sometimes combined with an incision into the parenchyma of the kidney. Another indication is the occurrence of **attacks of colic, accompanied by severe hæmaturia. This indication is sometimes vital;** in acute uræmia with sudden anuria, incision into the kidney is indicated **within forty-eight hours.** Operation.

Neuralgia of the Kidney.

We must be able to recognize this clinical picture of **acute paroxysms of intense pain, followed by** sometimes quite serious **hemorrhages.** Both symptoms are confined to one side. Albumin is absent in the interval time. Cylinders (hyaline, granular, and epithelial) are rare. Pains frequently radiate toward the bladder. The disease may have a course of many years.

These attacks are so **similar to those produced by stones** that it is rarely possible to make a diagnosis of neuralgia of the kidney with any certainty. But where the diagnosis is probable, and where the attacks are so serious as to demand their cessation, **probatory nephrotomy is indicated,** after internal treatment has proved useless. Frequently loosening of the kidney, decapsulation, and fixation arrest the attacks. If the hemorrhages are severe, extirpation is indicated.

Stones of the Kidney.

Kidney stones, like stones in the gall-bladder and fæcal stones in the appendix, **sometimes give no symptoms** whatever for a long while. Frequently, though, there is a **dull pain** in the region of the kidney, which is decidedly exacerbated by violent exercise, running, jumping, horseback riding. Frequently the pains radiate along the ureter into the bladder. Hyperæsthesia or anæsthesia is to be found often in the region of the iliohypogastric nerve.

As long as the stone stays quietly embedded, and no infectious proc-

Attack depends upon behavior of the stone.

esses are going on, the symptoms are usually mild. If a stone works loose and then becomes incarcerated, so to speak, **colics** appear. To this is added stagnation of the urine, producing hydro- or pyonephrosis, if the stone clogs up the ureter. At this stage, **infection** easily takes place. The urine, which may be comparatively clear in the interval, then becomes scanty and cloudy, frequently mixed with blood.

Profuse hemorrhages without colic are more frequent in the beginning of the disease than later. The attacks are very severe, the pain is excruciating, with frequent and painful micturition.

The condition of the urine depends upon whether the ureter of the diseased kidney is permeable. If it is not, and the other kidney is not affected, the urine during the attack may be perfectly clear with no sediment, but the quantity is, of course, reduced. But even if the other kidney is perfectly normal, its secretion may be arrested completely **(reflex anuria)** as soon as the ureter of the affected kidney becomes stopped up.

Duration.

The attack may last for a few hours, or several days. As soon as the occlusion is relieved, the stone either passing down into the bladder or falling back into the kidney, the attack is over. Afterward sometimes small sand is discharged. If the disease exists for any length of time, infection is sure to follow.

Diagnosis.

The diagnosis is easy if the symptoms are typical. In other cases again, it may be exceedingly difficult and even impossible. Exact anamnesis, sometimes crepitation, bimanual palpation, pronounced tenderness on pressure, frequent occurrence of light or severe hemorrhages, especially after exercise, the character of the pain, and disorders in the region of the iliohypogastric nerve, eventually a positive *x*-ray photograph will lead to the diagnosis (phosphatic stones are more permeable for *x*-rays, and give therefore a thinner shadow than the oxalate and uric-acid stones).

Probing of the ureters is too difficult and serious an undertaking to be used methodically.

Differential diagnosis.

In differentiation, the diseases of other organs can usually be readily excluded. Differentiation from other diseases of the kidneys is not so easy, but the mistakes are naturally less serious, the diseases mistaken for stone of the kidney (usually tuberculosis) requiring the same operation. Cystoscopy usually shows in tuberculosis marked changes of the ureteric opening into the bladder.

Surgical interference is vitally indicated if complete (double) anuria develops; one cannot wait longer than twenty-four hours for spontane-

ous relief. **Which kidney to operate on** is sometimes hard to decide. If both kidneys are affected, the one showing symptoms of occlusion last should be opened. In some cases both kidneys have to be operated on (one must not forget that sometimes only one kidney exists).

Another **absolute indication is the acute infection of the kidney,** which is characterized by high fever (sometimes 107° and 108°), and other severe symptoms, like vomiting, chills, extreme tenderness, etc.

Severe hemorrhages rarely compel the surgeon to operate.

Generally speaking, the **certain diagnosis of stones** in the kidneys should lead to operation, as the presence of stones is bound to lead to more serious complications, etc. The **mortality** is extremely low, and the effect of the operation excellent.

Movable Kidney.

The kidney is normally movable, following respiration. If the niche in which the kidney lies is abnormally shallow, under circumstances favorable to displacement, like abdominal pressure, or loss of fat, the kidney becomes movable in a degree which may necessitate surgical interference. The descent of the kidney is usually, though, only **one symptom** of a general giving way of the internal organs (Glenard's disease), which, of course, would not be influenced by any fixation of the kidney. **Operation is absolutely indicated** only when the kidney is so movable as to make a kink in the ureter, but the simple establishment of movable kidney does not call for any operation whatsoever. If the movable kidney seriously interferes with the occupation, operation is to be advised.

The operation is practically without danger, and the functional result is usually very good, recurrences being rare.

Cysts of the Kidney.

They are usually congenital, and come to observation only rarely as late as the second decennium. In about one-third of the cases, cysts of the liver have been observed at the same time.

The **diagnosis is important,** as the children, if not operated upon, usually die. The principal **symptoms are local.** The cyst is frequently so large that it can be observed by inspection. Palpation reveals its presence without any difficulty. There is usually no pain present.

The **urine** is frequently normal, sometimes very rich in albumin and blood, sometimes containing **characteristic rosette-form bodies.**

Exploratory puncture (from behind) establishes the diagnosis definitely.

Of **general symptoms,** hypertrophy of the heart and high tension of pulse are frequent. The general condition of the patient is usually good, until suppuration of the cyst ensues. Acute attacks of uræmia are quite frequent.

Diagnosis. The diagnosis may be quite difficult, if the cyst is not very large. The fluid obtained by probatory puncture frequently contains the above-named **rosette bodies,** and thus decides the diagnosis.

The cysts are usually **bilateral,** while other cystic degenerations, like echinococcus, are not.

The **differentiation** from hydronephrosis and pyonephrosis may be so difficult as to be practically impossible.

Nephrotomy is indicated only when the diagnosis of cyst is made.

The **prognosis is exceedingly infaust,** and the danger of the operation very great.

Echinococcus of the Kidney.

It occurs mostly between the twenty-fifth and thirtieth year, in men somewhat more frequently than in women. Echinococcus of the kidney is much **rarer than that of the liver.** The disease is nearly always unilateral.

The **local symptoms** are usually not striking, except where the echinococcus cyst reaches a large size. Pain is usually not present. Sometimes the size becomes considerably reduced, after a large number of echinococcus cysts have been discharged.

The **urine** may be perfectly normal, or if small **cysts have burst and infected** the contents of the cyst, it is cloudy, milky, sometimes bloody and containing pus. The **microscopical examination** shows the presence of scolices or even complete small cysts, but the absence of these two symptoms does not prove that we have not to deal with echinococcus.

Diagnosis. The diagnosis is probable, if we can prove the existence of a **smooth large cystic tumor** of the kidney, which has been growing slowly. If the presence of **echinococcus cysts or scolices** can be shown by the **microscope,** in either the urine or the fluid obtained by exploratory puncture, the diagnosis is manifest. If this latter is not possible, the echinococcus

nature of the cyst can frequently not be determined. The **differentiation** from ovarian cyst or tumor may sometimes be difficult.

Indication for operation exists as soon as the diagnosis is assured. If the diagnosis is only probable, **exploratory puncture** (from behind) is permissible. The operation in question is usually only **incision and evacuation of the sac.** In some cases, though, where **incrustation** has taken place, which prevents the collapsing of the wall of the cyst, its extirpation may become necessary. The simple incision and drainage is an operation of little danger, and the **prognosis** is decidedly good.

Congenital Abnormalities of the Kidney.

They rarely become objects of surgical interference, but are of importance for differential diagnosis. The most serious abnormality is the complete **absence of one kidney** which, even if rare, always must be thought of where extirpation of a diseased kidney is proposed.

This absence of one kidney is, of course, different from the so-called **horse-shoe kidney**, where the two kidneys form one more or less irregularly shaped organ with usually two ureters, the site of which is varying. This deformity is not so very rare, and has been found in about 1 to 1,100 post-mortems. The **other abnormalities,** like the unilateral elongated kidney, are much rarer. **Abnormal site** of one kidney is not so very rare, and has to be thought of in differential diagnosis.

Hydronephrosis and Pyonephrosis.

Hydronephrosis may be **congenital or acquired.** In the latter case the enlargement of the organ, where under certain conditions accumulation of urine takes place, is the result of **obstruction in the ureter.** The latter is caused either **by tumors,** stones, foreign bodies, etc., or by **strictures** due to inflammation, or by **adhesions** and bending of the ureter.

Causes of acquired hydronephrosis.

The **infection of a hydronephrosis, making the same a pyonephrosis,** usually takes place from the bladder in an ascending process. **Pyonephrosis may develop primarily,** and not only by infection of a preformed hydronephrosis. This happens **by septic thrombosis or embolism,** if from a septic focus small particles of infectious material are carried into the kidney by the vascular system.

Hydronephrosis is quite frequent among children. Pyonephrosis does not occur until after puberty.

Age.

The **symptoms of hydronephrosis depend largely upon the question of the mobility of the kidney.** If the kidney is fast, it frequently gives no symptoms whatsoever. The tumor is in its **lower part palpable.** Fluctuation frequently cannot be felt. Even a large hydronephrosis, if held up by paranephritic processes, may give the palpating hand the feeling of a normal kidney, as only the lower pole, which may be normal, can be felt, and the entire upper part of the enlarged kidney, which may reach very high up and displace the diaphragm, cannot be made out. **The changes in the size** of the hydronephrotic kidney **are characteristic.** This is accompanied by respective **oliguria and polyuria.** If the tumor becomes small, very **large quantities of urine** are discharged. If the passage is obstructed, the tumor grows and the urine becomes less. The **urine** may be either perfectly clear or very turbid, and frequently contains mucus, pus, and blood; sometimes granular and pus cylinders can be found. As long as the hydronephrosis is not infected, **pain is rare. Fever** does not occur frequently in hydronephrosis, but **is typical for pyonephrosis,** and may then be extremely high, with great remissions. If hydronephrosis was in the beginning unilateral, and the other kidney becomes affected, later on complete uræmia may set in.

Enlargement of kidney characteristic.

DIAGNOSTIC TABLE FOR FLUIDS GAINED BY PUNCTURE OF ABDOMINAL CAVITIES.

(According to Kuehnemann.)

Fluid.	Ascites.	Peritonitic Exudation.	Ovarian Cyst.	Hydronephrosis.	Echinococcus.
Nature and appearance.	More or less clear.	Mostly turbid (sero-fibrinous or purulent), rarely bloody.	Mostly turbid, viscid, yellow to brownish.	Mostly clear, rarely mucus, blood, or pus.	Mostly clear, amber-colored.
Specific gravity.	1,010 to 1,012.	1,013 to 1,015 and over.	1,018 to 1,020.	1,010 to 1,015 and over.	1,008 to 1,013.
Chemical ingredients.	Albumin up to two per cent.	Albumin, two to three per cent. and over.	Albumin and metalbumin.	Albumin, urea, uric acid.	Chloride of sodium, grape sugar, succinic acid.
Microscopic contents.	Leucocytes, endothelial plates, sometimes red blood corpuscles.	Numerous leucocytes, also endothelia.	Cylindrical and ciliary epithelia, colloid spheres.	Pavement and transitional epithelia (pelvis), sometimes cylinders (urine).	Sometimes scolices and hooklets; also hæmatoidin and cholesterin crystals.

Diagnosis.

For diagnosis the **intestinal tympanitic sound in front of the kidney** is of importance, thus proving that the tumor is retroperitoneal. The **differentiation** from other cystic affections of the kidneys is sometimes impossible. Cystoscopy and ureter catheterization will be of value.

If **pyonephrosis** is made out, **operation is absolutely indicated,** which

used to consist, until lately, of extirpation of the kidney; now, in many cases, **nephrotomy will be tried first,** even if the kidney forms a sac whose walls are not thicker than an eighth of an inch. This exceedingly reduced **parenchyma may do the entire work of both kidneys,** so that extirpation would be a fatal mistake.

Hydronephrosis, if of any considerable size, ought to be operated on, even if no immediate urgency exists. There are so many changes connected with this condition, which are likely to occur, that a prevention of these by operation is indicated. If nephrotomy is contemplated, the good condition of the other kidney has to be proven exactly.

Tuberculosis of the Kidney.

Tuberculosis of the kidney is due to infection either by the vascular system or by an ascending communication of the disease from the bladder. Frequently the disease gives no symptoms for a long while. In the **chronic cases,** the symptoms are of very indistinct nature. There may be **general symptoms** of tuberculosis infection, as loss of appetite, disorder of digestion, increase of uræmia, loss of flesh, fever of a hectic type, profuse night-sweats. At the same time **local symptoms** begin to appear: disturbances in micturition and changes in the composition of the urine. The **micturition** becomes frequent, or strangury exists. The **urine** contains blood and pus with mucus, and with flakes and granules. The reaction stays acid. **Hæmaturia** is frequently the very first symptom, and should always lead to the suspicion of tuberculosis.

Diagnosis.

The diagnosis is, of course, definite only if **tubercle bacilli** are found in the urine. This is sometimes difficult. They are usually **embedded in the mucus.** The urine has to be centrifuged and examined repeatedly before the result of the examination can be pronounced negative; nevertheless the positive proof is possible in only about one-third of the cases. **Pain** may be absent, or constant, or in attacks, and may be confined to the kidney or radiate toward the bladder and the thigh. Pain during micturition is present only if the bladder and ureter are infected too. Quite frequently the **enlarged kidney can be** distinctly **palpated and is tender** on pressure, especially if paranephritic processes are present. The duration of the disease is from one to five years.

Bacilli.

In establishing the diagnosis, the presence of tubercle bacilli is, of course, most important. **Smegma bacilli** must not be mistaken for

tubercle bacilli. In the absence of tubercle bacilli the diagnosis nevertheless can be made with great probability.

The swelling of the lips of the ureter in the bladder is recognized by cystoscopy.

If **cystitis** has been found to be constant and to resist any rational treatment, if, at the same time, the **temperature** rises in the evening, if **other tuberculous processes** can be found, and if **hæmaturia and colics** are present, the diagnosis of tuberculosis becomes certain, even without bacilli being found.

Probatory injection of tuberculin, with a typical reaction, confirms the diagnosis.

To establish the condition of the other kidney, examination of the urine gained by ureter catheterization is decisive.

Differentiation from a calculous kidney with infection may be difficult and sometimes not possible until during the operation.

Operation. If the diagnosis of tuberculosis of the kidney has been made, operative interference is indicated. The **total extirpation of the kidney** is only warranted under certain conditions, and **conservative treatment** is indicated in tuberculosis of the kidney as much as in any other form of tuberculosis. If the tuberculosis of the kidney is ascending, operation is indicated only for symptomatic reasons, as a cure then is most improbable.

Cryoscopy does not give definite results yet, and is therefore of no practical value to the general practitioner.

The **prognosis,** compared with the seriousness of the affection, is not bad, the **mortality** being about thirty per cent. In a good many cases, complete cure has been effected. **Without operation the prognosis is absolutely fatal.**

Tumors of the Kidney.

The **solid tumors** of the kidneys are in the majority **malignant,** viz., carcinoma and sarcoma in all their different types. Nevertheless it is necessary to know that **benign** tumors are also found, as lipoma, fibroma, osteoma, enchondroma, angioma, adenoma, and gummata. Besides these, we find also the so-called **hypernephroma** (struma suprarenalis aberrans) which is sometimes malignant and sometimes benign.

Another form of enlargement of the kidney may be produced by **aneurism** of the artery of the kidney. Those tumors are usually small, but in rare cases may grow to large size.

Hæmaturia.

The **first and important clinical symptom of a malignant tumor of the kidney is hæmaturia.** This may be slight and occur at long intervals, or assume a serious character from the start. It is characteristic that this hæmaturia is not in any way connected with violent exercise or motion, as is the case in kidney stones. By cystoscopy (if possible) we may see if the blood comes from the kidney. If the **blood coagulates,** large lumps are discharged in the urine. Sometimes the coagulated blood stops in the ureter, and causes colic like a stone in the ureter. Sometimes we find regular long angle-wormlike coagulated **casts,** which either look like fresh blood-clot, or are discolored. The latter, if discharged with perfectly clear urine, come surely from the ureter. If blood is discharged as soon as it comes into the bladder, the urine looks like pure blood, light red. If it has been kept in the bladder for any length of time, it appears more brownish. **Fibrinous coagula,** which are soft, white or yellowish to reddish, or the size of a maggot or larger, are **characteristic for tumors.** But even if the macroscopical examination does not show the presence of blood in the urine, blood can easily be detected with the microscope. Frequently the red corpuscles are washed out.

The alleged diagnostic value of a varicocelet on the same side as the diseased kidney is surely very small, if it amounts to anything.

Age.

Unlike carcinoma of other organs, it may attack children in the first ten years. The usual time, however, is between fifty and seventy. Sarcoma attacks children quite frequently.

A special type by themselves are the **congenital** (embryonal) **adenosarcomas,** which represent a mixture of sarcoma and carcinoma, and have been described as rhabdomyosarcoma. Their growth is immensely **rapid,** and they are practically inoperable, if they have attained any large size, which they do very quickly. **Their early recognition is therefore of the highest vital importance,** because they have little tendency to metastasis and do not produce amyloid degeneration, so that they really would offer good results, if recognized early enough.

Principal symptom.

The principal symptom of tumor of the kidney is, of course, the **palpable tumor.** If the tumor begins to grow in the upper pole, it may be impossible to feel or find it, until it has attained a large size, while those of the lower pole are easier to feel. Besides this, personal experience in ex amining cases of tumor, and good self-training are of the highest value.

Malignant tumors usually (not always) have an **irregular, knobby, hard surface** and are tender on pressure. The entire kidney may be enlarged, or we may be able to feel a knobby excrescence on a kidney of

DIFFERENTIAL DIAGNOSIS OF KIDNEY

(According to

	Abscess of Kidney.	Hydronephrosis.	Echinococcus of Kidney.	Cystic Kidney.
Consistency (fluctuation).	Not very tense, fluctuating.	Less tense, fluctuating.	Tense, fluctuating. (Hydatid thrill often absent, not characteristic.)	More or less tense, fluctuating.
Surface (size).....	Smooth, sometimes lumpy.	Smooth. Size varies with variable occlusion of ureter (periodic hydronephrosis).	Smooth. Size decreases on perforation of cyst, later on increasing rapidly after eventual occlusion of ureter and formation of hydronephrosis.	Smooth, if simple (large) cyst. If multiple small cysts, surface of kidney knobby.
Mobility (circumscribed).	Immovable and not following respiration. Quite distinctly circumscribed.	Immovable and not following respiration, unless complicated with movable kidney.	Immovable, follows respiration slightly.	Immovable, follows respiration slightly.
Site in relation to abdominal viscera.	Same as in carcinoma; but an abscess usually does not attain a size to be felt as a tumor through the abdominal muscles.	Same as in carcinoma, but only in case of large extent of hydronephrosis.	Same as in hydronephrosis.	Same as in hydronephrosis.
Urine.....	Copious pus. Sediment may comprise more than one-fourth of entire urine; consists mostly of pus-corpuscles. Rarely, also, particles of parenchyma. (Insures diagnosis.) Cylinders absent, except in diffuse affections of kidneys. Shingle-like arrangement of epithelia, or caudated epithelia, as found in pyelitis, also lacking. Blood present only if abscess is due to trauma or stones. Usually little albumin, corresponding to amount of pus.	Unilateral hydronephrosis gives normal quantity and character of urine; bilateral shows oliguria.	Emptying bladder shows urine to contain daughter-cysts, hooks and scolices, membranes.	Often normal; sometimes contains blood and albumin, if complicated with nephritis.
Pain (sensitiveness to pressure).	Present; often radiates to navel, thighs, and calves. Frequently also in region of kidneys.	Usually no pain, not tender on pressure; if complicated with pyelitis, often painful.	Usually present, radiates to genitals and thighs. Colicky pains when cysts pass ureter.	May be present (pressure on dorsal nerves and lumbar plexus).
Other symptoms...	Usually hectic fever and chills. Etiological factors important.	No fever (unless complicated with pyelitis). Probatory puncture, see page 256. Etiology important.	Usually no fever. Probatory puncture, see page 256.	Mostly congenital, rarely acquired by adults. Not rare in infants, combined with other anomalies.

AND OTHER ABDOMINAL TUMORS.
Kuehnemann.)

Paranephritis.	Carcinoma of Kidney.	Ovarian Cyst.	Retroperitoneal Glands.	Peritonitic Exudation.
First resistant, later soft, fluctuating.	Mostly hard, sometimes soft in spots, also fluctuating.	More or less tensely elastic, sometimes soft, fluctuating.	Mostly hard (carcinoma or sarcoma), sometimes fluctuating in spots.	Softer, fluctuating.
Smooth.....	Mostly knobby, lumpy; rarely smooth.	Smooth.....	Knobby.....	Mostly smooth
Immovable, follows respiration slightly.	Immovable, follows respiration slightly (unless complicated with movable kidney, rare).	Passively movable...	Mostly immovable, not following respiration.	Slightly movable, follows respiration. Indistinctly and irregularly defined.
Tumor in lumbar region, covered by smooth, shiny, later intensely red skin. First hard infiltration, later like dough, œdematous. Abdominal viscera not displaced.	Usually colon ascendens lies in front of right kidney; descending colon lies diagonally over the inner edge of left kidney (gives tympanitic sound). Liver and spleen displaced upward, with colon between (tympanitic sound); these organs and tumor do not touch (only if tumor is large).	Tumor lies under front wall of abdomen; loops of intestines behind and beside it. If patient lies on back, dulness above, tympanitic sound below and at sides. (In rare cases loops of intestine lie in front.) Often pedicle connecting cyst and uterus can be felt. (Exploration per rectum important.)	Same as in carcinoma, but tumor usually lies nearer the mesial line.	Usually lies superficially under the fascia, in front of colon or intestines. Percussion sound not entirely dull, but mixed with tympanitic sound.
Normal, except in complication with pyelitis and pyelonephritis, or on perforation of abscess into urinary passages.	Frequently hæmaturia, which occurs periodically; in the interval, normal; hæmaturia either pure blood or mixed with urine, little albumin. Carcinoma particles rarely present.	Normal.....	Normal, except in complication.	Quantity usually reduced, concentrated, with increased amount of indican.
Very pronounced in lumbar region and near lower dorsal vertebra Very tender on pressure at same points.	Frequently pains in region of kidney, radiating to legs. Also neuralgia of lower intercostal nerves. Anæsthesia and paræsthesia of legs.	Mostly pain in abdomen and sacral region. (Also disturbance of evacuation of fæces and urine, and breathing.)	Usually present: if tumor is large, symptoms of pressure on abdominal viscera.	Very painful and tender on pressure.
Fever regular, often intermittent. Sometimes begins with a chill; in secondary form always unilateral.	Cachexia, but may be lacking in some cases. Relatively frequent in childhood. SARCOMA gives the same symptoms, but hæmaturia is rare. Mostly occurs in children.	Usually no fever. Probatory puncture, see page 256. Often disturbances of menstruation, lactic secretion. Tumor grows upward.	Usually cachexia....	Often fever. Previous peritonitis important factor.

normal size. If the kidney grows, it will dislodge other organs. There is always **intestinal resonance** in front of the tumor.

In about twenty-five per cent the growing of a tumor is indicated by **pains** in the renal region and along the ureter. They may be of a dull character, or of torturing intensity. In the later course of the disease the pain is always pronounced.

Prognosis. Children usually succumb within a few months, at the very most one year, while grown persons live about two and a half years and sometimes longer.

The **diagnosis,** besides being indicated by all the symptoms mentioned above, is facilitated if cells of the tumor are found in the urine, or if enlarged inguinal glands can be demonstrated.

It is of great importance to decide if the tumor belongs really to the kidney. The **solid tumors of the kidney are absolutely immovable,** unless they are combined (rare) with movable kidney.

Differential diagnosis. Differentiation from **tumors of the liver** is sometimes not easy. The tumors of the liver grow upward, as well as downward. The left lobe is usually attacked at the same time as the **right** (which only can be mistaken for a kidney tumor). The lower ribs are bulged outward, and below the free edge of the ribs the tumor seems to be a direct continuation of the thorax. Tumors of the liver will in nearly all cases permit us to feel the **free lower edge** of the liver, which can be followed upward toward the left. The liver follows respiration, the tumor of the kidney is fast.

Tumors of the spleen are not easily mistaken for tumors of the kidney, as we can nearly always feel the normal form of the spleen.

Ovarian tumors are recognized as such by the fact of their rising from the pelvis. Therefore, palpated from outside, no free lower border of the tumor can be felt, and examination per vaginam shows their connection with the genital apparatus.

The differentiation from **retroperitoneal glands** may be very difficult, if not impossible. Decided changes in the urine are of importance, especially the presence of blood. The tumors of the kidney always lie laterally from the spine, while retroperitoneal gland masses are more in a mesial position.

Other affections. If hæmaturia is the first symptom, other diseases of the kidney which also produce this symptom and cause enlargement of the kidney have to be excluded, especially **tuberculosis,** and **calculous kidney;** but even **hydronephrosis, cystic kidney,** and **hemorrhagic infarct** may come into

consideration. Tuberculosis, in most cases, is proven by the presence of bacilli, produces temporary fever with profuse night-sweats, and shows reaction (increased pain and hemorrhage) after probatory tuberculin injections. If stones are present, the kidney is not so much enlarged, and frequently sand and gravel are discharged.

If the presence of a neoplasm of the kidney is established, operation is indicated, which may be only exploratory. If the kidney is exposed in the wound, the **final differential diagnosis** as to the nature of the tumor can usually be made. If the tumor is malignant, and the other kidney sound, the diseased kidney has to be removed. Operation.

Operation is contraindicated if metastases can be found (special attention should be paid to those of the bony system).

The **mortality** after operation is about twenty per cent, comparatively low for an otherwise absolutely fatal disease.

Perinephritis.

Perinephritis is a **phlegmon of the capsule** or the fat capsule, or the retroperitoneal fat. Suppuration behind the kidney is the most frequent form.

The **symptoms** are, first, indefinite fever, languor, sweats, and chills. In some cases the hip-joint is contracted in flexion; but extension only is arrested, while all the other motions are free. **Exploratory puncture** of the kidney (from behind) frequently soon gives pus. In the **later stages** there is a decided swelling in the lumbar region, and a **very important symptom, œdematous infiltration of the skin.** Usually a tumor is palpable, not following respiration and increasing rapidly. The enlargement of the kidney is more diffuse. The urine is frequently normal.

To make the **diagnosis** early, a **frequent exact examination** is necessary. If, besides the symptoms named, fever is present and a resistance is palpable, tender on pressure, and if leucocytosis is present, it is sufficient to make a **probatory incision.** If an exploratory puncture has proven the presence of pus, or if inflammatory œdema shows itself, **operation** is indicated also. The operation is practically without danger, and of the greatest immediate result.

Pyelonephritis and Suppurative Nephritis.

Frequency.

Suppurative diseases of the kidney are much more frequent in grown people than in children, and more frequent in men than in women. They are generally **caused** by the presence of foreign bodies, especially stones, rarely by small tumors and parasites; further, they occur as an ascending process after cystitis, finally as a result of infection.

The **diagnosis of pyelonephritis** is to be made if the **urine is cloudy** (pus), with no disturbances in the discharge of the urine, with no cylinders, and only a little albumin. If a **tumor in the lumbar region** can be felt, belonging to the kidney and decidedly tender on pressure, if after thorough washing out of the bladder, **purulent urine** can be expressed into the bladder by pressure on the tumor, if we can observe the entrance of purulent urine into the bladder with the cystoscope while the bladder is not affected, the diagnosis becomes certain.

Hæmatogenous abscess.

A hæmatogenous abscess of the kidney, with consecutive **perforation** into the pelvis of the kidney, may be recognized, if we can prove a **source of infection** in some other organ or a trauma, and if the disease begins suddenly with **chill and high fever** up to 107° and 108°, **local swelling** and tenderness, and sometimes sudden appearance of pus or blood, and renal elements in the urine. The **swelling of the kidney is the most important symptom.**

Differential diagnosis.

The differential diagnosis has to be made on the same lines as in other kidney diseases. **Tumors** of the kidney, liver, spleen, ovaries, and intestines are especially to be excluded. Repeated bimanual examination, if necessary under anæsthesia, must be made. The inflated colon and the inflated stomach lie in front of the kidney tumor. Vaginal examination excludes ovarian tumors. **Exploratory puncture (dangerous)** may be without value if the needle does not hit the abscess or the pelvis filled with pus. If the kidney is enlarged, this is very easily possible.

If the diagnosis is pus in the kidney, **immediate operation** is indicated. If the fever is very high, accompanied by chills and profuse sweats, an early incision is justified, even if all the clinical symptoms are not perfectly clear.

The **results** of the operation are always very apparent, at least for the moment. A great number of cases of suppuration of the kidney have been cured by simple incision; sometimes resection or even extirpation may become necessary. As otherwise those cases are nearly always fatal, **early recognition is vital.**

DISEASES OF THE SUPRARENAL BODIES (GLANDS).

The physiology, as well as the pathological anatomy, of the suprarenal glands has been recognized only so recently, that the diseases of these bodies have not yet become the object of surgical interest, as much as they deserve.

Addison's disease. Addison's disease is doubtless in most cases a **tuberculosis of the suprarenal glands,** which will become the object of surgical interference, like tuberculosis of any other organ.

For a detailed symptomatology of Addison's disease see the medical text-books. The **symptoms** are, briefly: in the beginning, tired feeling, adynamy and apathy, later on, dyspepsia, especially vomiting, irregularities of defecation—first, obstipation, later, diarrhœa—and pain in the epigastrium and the sacral region. The most **striking symptom is the pigmentation of the skin and mucous membranes.** The skin appears bronzed; the abnormal coloring of the skin is most pronounced where it is most exposed to the influence of sunlight, and the regions which are normally more pigmented, as the mammilla, armpit, and genitals. The **mucous membrane** of the mouth, lips, palate, and tongue shows more or less regular **brown to dark spots and streaks.** Headache, delirium, and progressive cachexia are frequently observed, and weakness of the heart and small pulse occur quite regularly.

If the symptoms are all present, the **diagnosis** is easy. If the diagnosis is Addison's disease, it means in at least eighty per cent tuberculosis of the suprarenal gland. As the **prognosis is otherwise absolutely fatal,** surgical interference ought to be recommended, and will doubtless be resorted to in the future.

Tumors. **Other diseases** of the suprarenal bodies are the formation of tumors, benign as well as **malignant,** the latter more frequent. The hidden situation of the organ will make the **diagnosis of a tumor** possible only in exceptional cases, unless it has attained a size which forbids operation. Nevertheless, these tumors have been diagnosed rightly, and operated upon successfully. They sometimes may be mistaken for tumors of the kidneys, and will then be recognized during operation.

INJURIES AND DISEASES OF THE BLADDER AND PROSTATA.

The **bladder is examined** by inspection, percussion, palpation, catheterism, cystoscopy, and digital examination. Of all these, **catheterism and cystoscopy** are by far the most important methods. Both techniques are far easier in women, and sometimes extremely difficult in men. Catheterism in men is an operation by itself, and skill in it has to be acquired by experience. While it is impossible to enter into details as to all the different instruments, it must suffice to say that it is always safest to try those of largest calibre first. In a great many instances, especially in older men, the Mercier catheter is of great value, and also that of Bénniqué. Cystoscopy has frequently to be done under general anæsthesia, or under local anæsthesia with cocaine.

Catheterization.

CONGENITAL ANOMALIES OF THE BLADDER.

Ectopia of the bladder is a congenital malformation, where the entire anterior wall of the bladder is missing, and the rear wall of the bladder protrudes from the abdomen as a tumor. Usually other anomalies are combined with it. It is easily recognized, and if the anomaly is very pronounced, it is really more of anatomical than surgical interest, though lately a number of methods have been devised for closing this defect.

Cystocele (Hernia of the Bladder).

A part of the bladder is frequently found in the contents of hernias, even if they are not very large. Sometimes this does not give any symptoms at all, as is indicated by the many cases in which the bladder has been accidentally found in the contents of a hernia during operation. If the cystocele is more pronounced, **disturbances in urination** result. The patients have to assume a certain position if they want to urinate, sometimes pressure of the hand on the bladder is necessary. A sure sign

Symptoms.

is that the **hernia increases in size** if the bladder becomes filled, then we feel in the outer inguinal ring a fluctuating, round tumor usually irreducible, even if the intestinal part of the hernia can be replaced. Sometimes the introduction of a catheter shows the nature of the hernia.

It is very necessary to recognize this condition, to avoid accidental injury of the bladder during operation.

INJURIES OF THE BLADDER.

Injuries occur most frequently when the bladder is filled, and mostly with fractures of the pelvis.

Rupture of the bladder occurs in men in ninety per cent. of all cases. Causes.
It may be due either to a kick, etc., in the bladder region, or to a fall of the patient from a certain height, or to direct force, as being run over, etc. In the latter case, **fracture of the pelvis** is frequently combined with it. Of all the injuries of the bladder, rupture is the most **dangerous** one. Its symptoms are principally those of **shock,** which may increase to complete loss of consciousness, and may be followed by death. If the patients come out of the shock, they complain of **violent strangury,** without being able Symptoms.
to pass urine even with the greatest exertion; only a few drops of blood, or bloody urine, are discharged. Soon violent **pain** in the entire abdomen ensues, with nausea, vomiting, and other **symptoms of acute peritonitis.** Frequently soon after the rupture a circumscribed painful, tense **tumor** can be felt. If a **catheter** is introduced, which is usually easy, the bladder is found empty and only a few drops of blood are discharged. The collapsed bladder is to be explored with the catheter, which may after some movements suddenly find its way into the abdominal cavity, when large masses of bloody urine may suddenly appear.

Accidental rupture of the bladder **in artificial filling** of the same under too high pressure is, of course, very characteristic. The resistance felt up to that time suddenly gives way, and the round bulging tumor of the filled bladder, plainly to be seen until then, suddenly disappears. Besides, the catheter evacuates little or no fluid.

In case of fracture of the pelvis and other possible injuries, differential diagnosis has to be made between **rupture of the kidney,** rupture of the Differential diagnosis.
bladder, and rupture of the **urethra.** Ruptures of the bladder may be, according to the situation of the peritoneum, either **intra-** or **extraperitoneal,** differentiation of which is frequently impossible. Even if a tear should be extraperitoneal, the danger of **urine infiltration and infection**

is practically the same, and the infection may pass through the uninjured peritoneum.

Injuries of the bladder with an external wound are produced by cut or shot, and are usually easily recognized. They are rare, and comparatively more frequent if the bladder is filled, and correspond practically with the rupture of the bladder. The outer wound is usually in the anterior wall of the abdomen, only in rare cases in the perineum by impalement.

Accidental wounds of the bladder and ureters have not very rarely happened after extirpation of large intraperitoneal tumors.

Foreign Bodies in the Bladder.

All sorts of foreign bodies are found in the bladder, which enter the same through the urethra. They are easily recognized with the cystoscope. The discovery of a foreign body in the bladder with a sound is not so reliable, as it may evade the touch with the sound if it is situated in a pocket.

Stone in the Bladder.

Stones in the bladder are either solitary or multiple. **Solitary** stones are usually **kidney-stones,** which have passed down the ureter into the bladder, and have grown there in size by accumulation. Other stones form around parasites (embryos of distoma hæmatobium and filaria sanguinis), or around deposits of stagnating urine in cystitis.

Varieties of stone.

They are more frequent in men than in women, and occur quite often in children. They are of variable **size, form, and chemical composition,** and may become as large as a fist, while the usual size is about that of a hen's egg. One special form ought to be mentioned, as it produces a **characteristic symptom,** that of **complete occlusion** of the bladder, according to the posture of the patient. This stone has the **shape of a gourd** (Pfeifenstein).

Many calculi exist for years without any symptoms. Usually, though, the **pain** connected with them is quite marked. It is felt in the bladder, as well as along the urethra and in the glans. Frequently the pain is started or increased by jolting; it is most pronounced toward the end of micturition. The same is true of **hæmaturia.** Disturbance in micturition consists in **strangury,** usually not affecting the stream, except that the latter is sometimes interrupted suddenly, especially when the

Symptoms.

SINGLE LARGE STONE IN BLADDER.

patient is in a standing posture. The sufferer feels as if a foreign body stopped the stream, and he tries to give the stone another position by all sorts of movements of the body. Frequently there is a desire to **defecate during micturition.** This is caused by painful contractions of the rectum during the passage of the urine. All these disturbances increase with the size of the stone.

As soon as the symptoms lead the physician to assume the presence of a stone of the bladder, the **diagnosis** is easy. Usually it can be detected by the introduction of a **stone-sound**, a metallic sound with a short beak, similar to the curve of the prostatic catheter. For this examination the bladder is filled with about 100 c.c. of fluid. If the patient is very sensitive, **injection of cocaine,** as for cystoscopy, is practised. If no stone is felt, one must not forget to feel for it right under and below the prostate, especially if the same is hypertrophied.

Examination with sounds.

If the sound touches the stone, a distinct **metallic click** can be heard and demonstrated to the by-standers. If the stone is very small, it may easily evade the sound; either it is hidden in a pouch or fold of the bladder, or it is so covered with mucus that the metallic click is not forthcoming.

Much more reliable is the examination with the cystoscope. All the details of size, position, and number of stones can easily be solved by this method, if one is conversant with it. Still more convenient, where no technique at all is necessary, is the **x-ray photograph.** The urate, oxalate, phosphate, and cystine stones, all give shadows. This method is of special value in children, as their examination with the sound or cystoscope is difficult.

DISEASES OF THE BLADDER.

Cystitis.

Inflammation (catarrh) of the bladder is frequently a disease by itself, while in other cases it may be only a **symptom** of some other disease. The signs differ in acute and chronic cystitis. In both cases the **local symptoms** are so pronounced that the general indications, as fever, loss of appetite, vomiting, etc., do not come into consideration.

In **acute cystitis** the **cramp and pains** in the bladder region and surroundings are foremost, while in **chronic** catarrh these symptoms are only light and the principal local symptom is the desire for **frequent micturition.**

Cystoscopy, if possible, gives the **diagnosis** at once. Besides this, the examination of the **urine** and **microscopical examination** of its contents is important. The urine is more or less turbid, contains mucus, pus, blood, leucocytes, bladder-epithelia, and always **bacteria.** These are responsible for the cystitis. They are principally staphylococci, streptococci, proteus, bacterium coli, and gonococci.

Differential diagnosis.

Many of the local symptoms, pain in micturition, intense strangury, and pus in the urine, are frequently found in **renal affections,** as tuberculosis of the kidneys, or nephrolithiasis, as well as in cystitis. If the **vesical symptoms change** suddenly and frequently, without any apparent explanation, it is probable that the inflammation has its site **outside the bladder.** Exact examination of the kidneys, the urine, and the bladder, eventually the separate collection of urine from each kidney, will frequently prove the **renal origin.** If the **mucous membrane** of the bladder **is very tender** to the touch with the catheter, or on pressure from the vagina or rectum, a **bladder affection is probable,** and a renal affection improbable. Differentiation of a **urethral** affection from a **bladder** affection may sometimes be quite difficult. Frequently, of course, a cystitis exists with a renal disease and then the bladder affection may have been the primary cause and the kidney been infected secondarily by ascension, or vice versa. A very frequent cause of the infection is **unclean instruments,** or other foreign bodies. After this, **gonorrhœa** is the most frequent cause. Other general infectious diseases may produce cystitis as a symptom.

Kidney and bladder affection combined.

As to **high temperatures,** it is necessary to know that catheterization, even when infection can be excluded, may cause very high temperatures, even with chill.

One form of cystitis is caused by the presence of **stone** in the bladder. It is **characterized** by more frequent **hæmaturia,** and the occasional presence of sand and crystals in the urine. Besides this, the **pains** are very violent, in spite of the chronic course of the disease.

In **examining the bladder** with sound and cystoscope, we have to remember that a chronically diseased bladder very frequently has **pouches,** which may be overlooked in one or the other examination, if the bladder is in a state of contraction.

Operation.

If the usual rational internal treatment, washing out of the bladder, careful local treatment, and insertion of a stationary catheter, are without result, and there is no other organic cause for the cystitis, **suprapubic incision** is indicated to put the bladder at rest. This **operation is contra-**

indicated if the cystitis is only a symptom of a central lesion, for instance, disease of the spinal cord, as the cystitis would recur at once, as soon as the bladder was closed again.

Enuresis Nocturna.

The inability to control the bladder during the night may be either only a **symptom of a central lesion**, or due to some **local** anatomical condition, or to enuresis as such; only the latter form shall be dealt with here. In some cases the enuresis is doubtless of **specific** origin. In a great many cases, though, local reasons can be found, as **stones** of the bladder, **stricture** of the urethra, or **phimosis** (very frequent). The disease is more frequent in boys than in girls, and exists up to the fourteenth year. Causes.

If all internal treatment and local methods have been without avail, if enuresis occurs frequently, and if the child is run down very much by eczema, etc., and still far from the age where enuresis usually stops, **epidural injection in the sacral canal is indicated,** either one-half per cent of cocaine or physiological salt solutions to be used. There is practically no danger connected with the operation, and the results are very good.

Tuberculosis of the Bladder.

It is usually only a symptom of a primary tuberculosis of the kidney. If the tubercular **cystitis is primary, the urine** for a long while **is acid.** The principal, and usually the first, **symptom is hæmaturia.** If there are no other reasons for its appearance, it may be considered **pathognomonic,** especially if **stones** of the kidney can be excluded. If a person inclined to tuberculosis, or affected by tuberculosis of some other organ, shows cystitis, the tuberculous nature is probable, which becomes certain after tubercle **bacilli** have been found in the urine; the diagnosis may also be confirmed by cystoscopy. Diagnosis.

If tuberculous **cystitis is secondary,** the treatment of the primary infection is indicated. Surgical treatment of a tuberculous kidney cures tubercular cystitis. If there is tuberculosis of the genitals, that has to be treated first, but if the tubercular cystitis is a primary infection, and all local treatment of no avail, **operation is indicated,** which consists of curettage and cauterization, with or without suprapubic incision. If the bladder is in a state of very acute infection, the latter operation ought

to be performed. The results are sometimes such as to alleviate the gravest symptoms considerably. In rare cases the disease is cured, in other cases local recurrences are observed.

Tumors of the Bladder.

There are a number of different types of neoplasms of the bladder, which may be either **primary or metastatic.**

Papilloma.

Rare and of little interest are myxoma, myoma, fibroma, cysts, and sarcoma, while **papilloma and carcinoma are frequent.** The first, also called fibroma papillare, is a **villous tumor,** the ends of which float in the urine of a distended bladder. They may fill the entire bladder. **Carcinoma** is by far the most frequent neoplasm of the bladder. It may show a papillary surface, or be more of a flat character, or appear in the form of ulcers.

The principal and usually the **first symptom is hæmaturia.** The hemorrhage starts without any apparent reason, lasts for several days, and then stops suddenly, sometimes not to occur again for several weeks. The urine first discharged is perfectly clear, becomes later on bloody, finally pure blood is discharged. If blood coagula close up the urethra, **retention** follows. Floating parts of the tumor may occlude the urethra for a time. Benign tumors do not cause any pain.

The **diagnosis** is made by cystoscopy; only when that is impossible on account of constant hemorrhage, other methods, as examination with the sound, etc., are in order. The differential diagnosis is especially important from **tuberculosis** of the bladder, which also is initiated by hæmaturia; as soon as tubercle bacilli are found, this question is settled. Sometimes **enlargement of veins** (varices) may burst and produce hemorrhage, which might be laid at the door of a tumor.

Differential diagnosis.

The **prognosis** in **benign** tumors is absolutely good, if not detected too late, for they have a tendency to carcinomatous degeneration. Nevertheless all tumors of the bladder are to be considered a very serious affection. The principal **danger is hemorrhage and degeneration.**

Operation.

Extirpation of the tumor (if very small, through the urethra, with the aid of the cystoscope), usually from a suprapubic incision, gives good results. If the **tumors are very large,** or with a broad basis, or of a malignant character, the operation becomes very difficult, and the **prognosis exceedingly infaust.**

There are some forms of acute severe **hemorrhage of the bladder**

where, at least for the time being, an etiological factor of this occurrence cannot be found. If the hemorrhage is so severe as to endanger life, immediate suprapubic section and tamponade of the bladder is indicated, which always controls the hemorrhage.

DISEASES OF THE PROSTATE.

Prostatitis.

Acute prostatitis is usually **caused by gonorrhœa.** The **symptoms** are, violent **pain** in the region of the prostate, with a **feeling of heaviness and heat** in the bladder region. These **pains are increased** during defecation and passing urine. The **perineum is tender** on pressure. **Examination per rectum** shows a hard, tense, hot, tender tumor. The swelling may involve either the entire organ, or only one of the lobes. Clinical course. In later stages, pressure on the tumor may bring forth a few drops of **purulent discharge from the urethra.** The **temperature** is high, chills are frequent. In by far the most cases the forming **abscess** of the prostate **breaks through into the urethra,** after which the acute stage immediately subsides, usually followed by a subacute or chronic form. If the pus does not take this course, the next possible thing is **perforation into the rectum,** or pelviperitonitis with thrombophlebitis, pyæmia or sepsis.

The **chronic form** shows as a principal symptom, the **discharge in drops** of a usually clear, sometimes milky, thready fluid per urethram. This takes place especially during defecation.

Tuberculosis of the prostate is so rare that it only needs to be mentioned.

Hypertrophy of the Prostate.

It is a very frequent disease in later life.

The **first symptom** is usually **strangury,** which becomes after a while painful. After **micturition,** some dribbling continues. To start micturition, the patients have to use more force by abdominal pressure, and the stream is thin. At certain intervals, complete **retention** occurs. This produces **incontinence** in the form of the so-called incontinentia paradoxa, *i.e.*, the bladder, after being filled to its utmost capacity, simply flows over. This undue distention of the bladder produces **paralysis of the muscles** of the bladder, so that the contents can no longer be entirely

expressed; the patients have residual urine. This in turn again produces cystitis, frequently increased by unclean catheterization.

In **examination with the sound** or catheter, it is necessary to remember that the **anterior wall** of the urethra is in all cases smooth and **not affected,** so that all instruments to be used must have the form, and must be led in a way to make use of this factor. Any undue force is to be avoided so as not to make false passages. As mentioned before, the largest sound is always the safest. Cystoscopy is frequently impossible.

Tumors of the Prostate.

Fibromas occur, but are rare. **Sarcomas** appear in youthful patients, while **carcinoma** occurs in old people, usually on the basis of hypertrophy. Besides the general **symptoms of enlargement** of the prostate described above, **blood in the urine** is the principal symptom. The diagnosis of carcinomatous degeneration of the prostate is extremely difficult, if not impossible.

INJURIES AND DISEASES OF THE URETHRA AND PENIS.

Venereal diseases will not be dealt with, as they do not strictly belong to the realm of surgery.

INJURIES AND DISEASES OF THE MALE URETHRA.

The **anamnesis preceding the examination of the urethra** has to state frequency of **micturition, pain** during and after the same, **form of the stream,** if thin, twisted, divided, in drops, or suddenly interrupted, color and other qualities of **urine,** discharge or bleeding from the urethra. In many cases **chemical and microscopic examination** of the urine has to be made.

Examination of the urethra can be made by inspection and with sounds. There are a great number of different **endoscopes** devised, nearly all fitted with electric light, many of which are good and serviceable. The efficiency of the examination depends not so much on the instrument as on the man behind it. It requires a certain technique, and one has to be familiar with the pictures to be seen, to interpret the same rightly. **Bougies and sounds** are used for examination, as well as for therapeutic purposes. They are made of metal, stiff or pliable, or are elastic. Of the former, I call special attention to Bénniqué's, which are not used in this country as much as they deserve. Before use, these instruments must be sterilized. Metal sounds are **boiled,** the others are disinfected by **formalin,** which is used in the form of tablets introduced in the glass vessels in which the bougies are kept. One must know that the latter become slightly corroded after having been exposed a long time to the formalin vapors, thus losing their smooth surface. They have to be **lubricated before insertion,** with sterile olive oil, glycerin, or sterilized vaseline in tubes. The glans and the external meatus of the urethra have to be **cleaned before insertion** of the instruments. As mentioned above, the **largest** possible size of sounds ought always to be

Instruments.

Sterilization.

tried. No force must be used, the sound being held as lightly as a drawing-pencil. (See Plate II.) *Cave* hemorrhages and false passages! **High temperature,** even after aseptic sounding, sometimes occurs.

Congenital Deformities of the Urethra.

Of congenital deformities which come under clinical observation, I mention congenital **strictures and stenosis** of the meatus, which are generally not observed until some years after birth. They are usually easily recognized from the symptoms observed by the patient. Examination with the sound reveals the impediment.

Diverticula. Diverticula of the urethra are also observed. They are usually near the glans, or right behind it. If the diverticulum is filled with urine, the penis assumes a grotesque form. The **principal symptom** is disturbance in the discharge of urine, sometimes incontinence. The sac behind the glans, if filled with urine, fluctuates, and is easily recognized.

Epispadia. Epispadia occurs in different grades. Usually it is **complete,** where the urethra stops at the root of the penis, the latter showing only an open groove from that point on to the glans. The deformity is recognized as soon as seen; the **principal symptom is incontinence,** with all its annoying features. Usually the development of the **intellect is impaired.** Later on, the sexual functions are greatly hindered, the member being unusually small, frequently not erectile, and if so, the discharged semen usually does not enter the female genitals.

Hypospadia. **Hypospadia is more frequent than any other congenital deformity.** According to the **point where the urethra ends** in the penis, we distinguish glans-hypospadia, penis-hypospadia, and scrotal hypospadia. In all cases the deformity is recognized at once. The lighter degrees of the first form really give no symptoms, while in the other two forms the condition is usually very bad. The only trouble in diagnosis might be that in very pronounced cases the sex might be mistaken.

INJURIES OF THE URETHRA.

Aside from the injuries of the urethra in the form of **wounds** by cut, stab, shot, and tear, the injuries by **blunt force** are those most frequent and most important.

The injuries of the urethra **caused by the fracture of the pelvis** have been mentioned in that chapter. All the other injuries are by **direct force** at the seat of injury.

The symptoms vary according to the extent of the contusion or tear of the urethra. Light **contusions** usually produce only a painful **swelling and suggillation** in the perineal region; hemorrhage from the urethra may be entirely absent, and the discharge of urine may not be interfered with. If the **urethra is torn,** partially or entirely, the **hemorrhage** from the severed ends is most severe, producing a more distinct tumor. The swelling usually spreads quickly over the scrotum, penis, and inguinal region, and shows a **characteristic** dark blue to gun-metal-like **discoloration.** But the **hemorrhage** from the meatus of the urethra **is not a sure indication** of the extent of the injury. In spite of a complete tear, it may be entirely absent, if the distal end is clogged by coagulated blood. Later on, the **most important symptom is the impossibility to discharge urine,** and the **urine infiltration** of the perineum. The differential diagnosis has to deal only with the possible injury to the **bladder.** In the latter case, the introduction of the catheter offers no difficulty and produces bloody urine, which also is discharged spontaneously. **Catheterization** is necessary for diagnostic as well as therapeutic purposes. If the introduction of the catheter is impossible, immediate external urethrotomy is to be recommended.

Symptoms.

Differential diagnosis.

Wounds of the urethra, by sharp instruments or the like, produce the same symptoms, but lead more directly to the seat of the injury.

Strictures of the Urethra.

The most frequent cause for strictures of the urethra is the formation of a **circular scar,** produced by an ulcer due to gonorrhœal infection. These strictures are usually **multiple.** There are **typically at least two,** and sometimes as many as six, **places where the calibre of the urethra is narrowed.**

Cause.

The principal symptom is, **change in the form and diameter of the stream;** it frequently is deviated, twisted, or divided. **Seropurulent discharge** from the urethra is sometimes present. The narrower the stricture becomes, the more **strangury** develops, the smaller is the quantity which is discharged at each micturition, and the more the pain increases. Finally the bladder is no longer emptied, with the result of **stagnation of urine,** producing inflammation of the bladder, and, in the final stage, ischuria paradoxa. If any of these symptoms are present, a **local examination of the urethra** becomes necessary. For this purpose in many cases a **preparatory injection** of a two to three per cent cocaine solution

Symptoms.

Examination.

is advisable. The **sounds,** either bougies *à boule,* or Roser's or Bénniqué's sounds, are to be **sterilized** most carefully, after which we begin with the introduction of the largest size, about No. 24. We then feel from the resistance where the **stricture is situated,** if it is circular or valvular, etc. To measure the **exact calibre,** a urethrometer, Otis's or any other, may be introduced, if the stricture is not too tight. If the stricture is very narrow, all these instruments are unavailable, and the only sounds to be passed are the finest whalebone sounds, or the metal sounds of Le Fort or Bénniqué, at the end of which a very thin elastic French bougie is screwed on. Frequently the diagnostic efforts are at the same time accompanied by therapeutic results.

It cannot be repeated too often that the examination is a matter of personal experience and technique, and that under no circumstances must any force whatever be used.

Foreign Bodies in the Urethra.

These are either introduced for onanistic purposes, or are urethral stones. Exceptionally a piece of catheter or bougie broken off in the bladder may become wedged in the urethra. **Endoscopy** and eventual **Roentgen pictures** will reveal the presence of the foreign body. Sounds are to be used only with great care, not to push the foreign body farther back; and, besides, if there are any pouches, the sound may pass a foreign body.

Stones of the urethra nearly always have their origin in the bladder. In children, kidney stones are frequently arrested in the urethra. The

Symptoms.

symptoms vary according to whether the stone has been present in the urethra a long while, or has entered the same **suddenly.** In the latter case, occlusion of the urethra is naturally the principal symptom, producing **retention; pain** is also present. Where the stones are in the urethra a long time, there is frequently very little discomfort. In nearly all cases the stones can be felt from the outside. Sometimes an examination per rectum is necessary.

DISEASES OF THE URETHRA.

Tuberculosis of the urethra does happen, but is extremely rare. The diagnosis rests on the recognition of **typical tubercular nodules** or ulcers, a scraping of which may disclose tubercle bacilli.

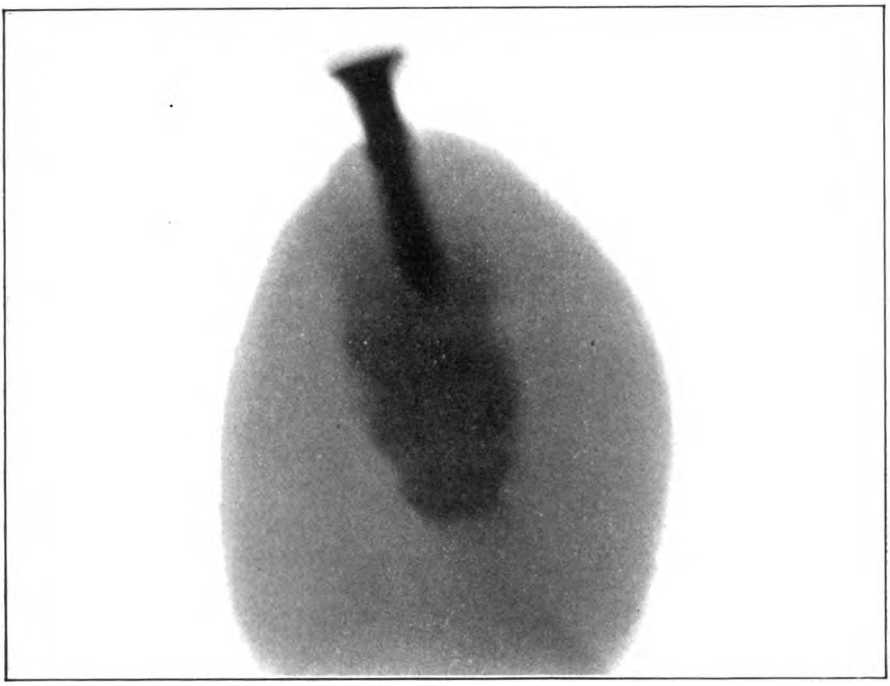


FIG. 2.

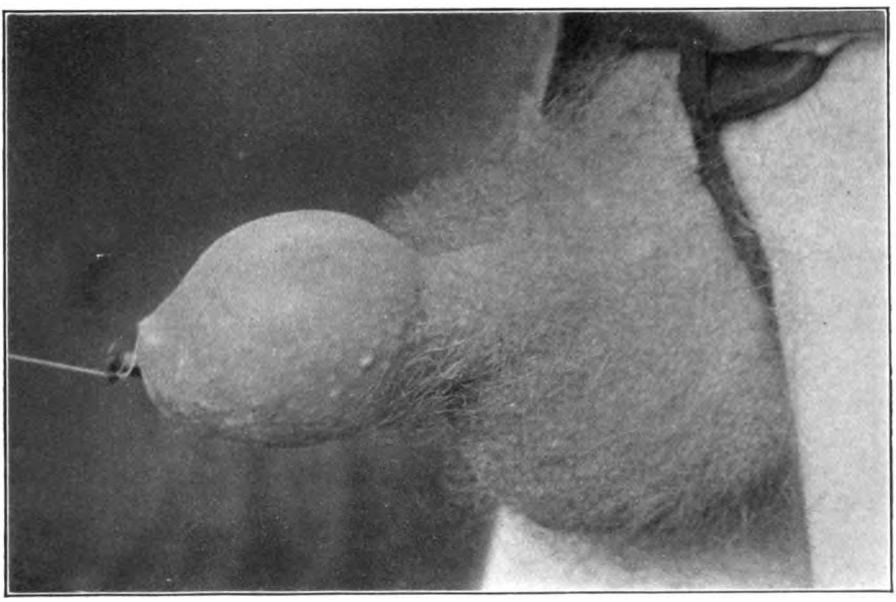


FIG. 1.

STEEL SCREW IN PREPUCE.

FIG. 1. Unique method applied by patient with incontinence of urine. Thickened edge of phimosis developed a thread for screw.

FIG. 2. Skiagram of the same specimen.

Of the **tumors** of the urethra, papilloma and polypi are not very rare. They are easily recognized by the endoscopic method.

Carcinoma of the urethra, which is usually secondary and only in rare cases primary, is of importance. Its presence is recognized by endoscopy, during which small particles are scraped off for microscopical examination, which decides the diagnosis.

CONGENITAL DEFORMITIES OF THE PENIS.

Congenital defects of the urethra are described under that heading. **Complete absence** and deformity of the penis, as cleft penis with hypospadia, are so rare that they need only to be mentioned.

Congenital phimosis is a condition worthy the full attention of the physician. In some instances, nurses or mothers become aware of this condition, but in most cases other indications may lead us to the examination for phimosis. Among these are, principally, umbilical hernia, inguinal hernia, hydrocele, hindrance to micturition, or inflammation of the prepuce. Prolapse of the rectum is also quite frequently observed in these cases. **Enuresis nocturna is nearly typical for phimosis.** In many cases erections are produced, which lead to masturbation. Phimosis.

Acquired phimosis is usually due to diabetes, where the free edge of the prepuce becomes hardened and like cartilage, thus hindering or preventing the denudation of the glans.

I may mention a unique use of a phimosis in later years, where a man with complete paralysis of the bladder, following an injury of the spine, made use of a one and a half-inch steel carpenter's screw to occlude the phimosis, in order to use the prepuce as a receptacle for urine. It was capable of holding about three ounces. Case.

A shortening of the frenulum is easily recognizable, if it exists with an otherwise normal prepuce, as soon as the latter is pushed back.

INJURIES OF THE PENIS.

Wounds of the penis by cut, stab, or shot are rarely accidental, and are usually either self-inflicted by insane persons, or are the result of a criminal assault, usually perpetrated by jealous women during coitus. If the penis was in erection at the time of injury, the **hemorrhage** is quite serious.

By machinery.

A peculiar injury, which I have observed a number of times, is the so-called **flaying of the penis,** where a belt or some other revolving part of machinery catches the prepuce, thus tearing off the complete skin-covering of the penis up to the root. If the skin does not tear, a so-called **luxation of the penis** may occur under the skin of the abdomen, symphysis, or scrotum. This condition is easily recognized. The very limp, skinny bag is empty, and the penis can be felt wherever it becomes dislocated. After a while, the urine drips from the glans, and finally from the prepuce. If the condition is not alleviated soon, urinary infiltration follows.

Of other **subcutaneous** injuries, we have to mention the so-called **fracture of the penis,** which is a subcutaneous tear of the corpora cavernosa during erection. The so-called fracture may take place in any part of the corpus cavernosum, external to the symphysis. In fresh cases it is easily recognized by the **hæmatoma,** sometimes discharge of blood from the urethra, and the **local pain,** besides the history. In old cases the erection of the penis is frequently interrupted at the seat of the injury.

Constriction.

Constriction of the penis is the result of the application of some elastic or unelastic ring while the penis is relaxed. The stasis produces an erection, which may last exceedingly long, causing gangrene. Irresponsible child nurses sometimes apply rubber rings or like contrivances to boys with nocturnal enuresis. Other similar appliances are used for masturbating purposes, producing the same effect. If the swelling has become very great, the constricting ring may easily disappear, and must not be overlooked.

DISEASES OF THE PENIS.

The most frequent **inflammation** of the penis is the acute inflammation of the surface of the glans, and that of the inner layer of the preputium. They always occur together, and only in cases in which the prepuce is rather long.

Balanitis.

The **principal symptoms** of balanitis are swelling and redness of the glans and prepuce. The latter is frequently œdematous, and discharges thin pus of bad odor. The patients complain of itching and burning. The **inguinal glands** are sometimes affected. While this form of balanitis is usually caused by lack of cleanliness and mechanical insults, there is a **spontaneous balanitis,** which occurs in diabetic persons, producing a phimosis, where a hard, cartilage-like ring at the distal, free end of the prepuce prevents its retraction.

ELEPHANTIASIS OF LABIA MAJORA ET MINORA.

The **acute non-diabetic balanitis** may also produce an inflammatory phimosis, a condition which can usually be recognized at the first glance, while the etiological factors, like ulcerations of the glans, etc., may not be recognized until the incision of the prepuce is made.

A frequent sequel of congenital, as well as of acquired, phimosis is **paraphimosis,** where the prepuce, after having been forced behind the glans, cannot be brought forward again. After a very short while, swelling and œdema ensue, and we find behind the sulcus a double ridge, between which is embedded the constricting ring. The distal ridge belongs to the inner layer of the prepuce, the proximal one to the outer. The **frenulum** can be followed from the meatus of the urethra to the ridge, thus **differentiating** this form of paraphimosis from artificial constriction by a metal ring, or like foreign bodies.

Phlegmonous processes and lymphangitis occur only rarely, and are easily recognized as such. One special form, which occurs on the penis and scrotum, usually together, is the apparently **spontaneous gas phlegmon,** produced either by the bacterium phlegmonis emphysematosæ, or by the bacillus coli. The cases are usually **fatal.** Phlegmons.

Elephantiasis of the penis and prepuce occurs, like elephantiasis of the labia, very rarely. The accompanying illustration is of a case of the latter form which came under my own observation.

Tuberculosis of the prepuce is not so rare as the professional Jewish circumcisers would lead us to believe. The infection usually takes place by the operator's sucking of the wound, according to the custom at this rite.

Tumors of the Penis.

Condylomata (acuminata) occur quite frequently on the penis, and are of interest only when they grow to a large size in cauliflower form, where they may be **mistaken for carcinoma;** but in the latter the base is infiltrated, and there is more tendency to ulceration in the carcinomatous affection.

Cornu cutaneum is comparatively rare. By its hard, peculiar consistency and form, resembling a horn, this tumor is easily recognized as soon as seen. Fig. 19 shows a case from my own practice.

Carcinoma is by far the most frequent form of all tumors, malignant as well as benign, of the penis. It occurs in the cauliflower, or ulcerative, or solid form. Like all other places where the borders of different types of epithelium meet, the sulcus is a place of predilection for the de-

velopment of cancer. **Preputial psoriasis,** producing mother-of-pearl colored specks on the glans, **is very characteristic as a beginning symptom** of cancer of the penis. Frequently the cancer is not recognized until it has grown through the two layers of the prepuce. **Pain** usually occurs only in the later stage, radiating from the glans into the anal and

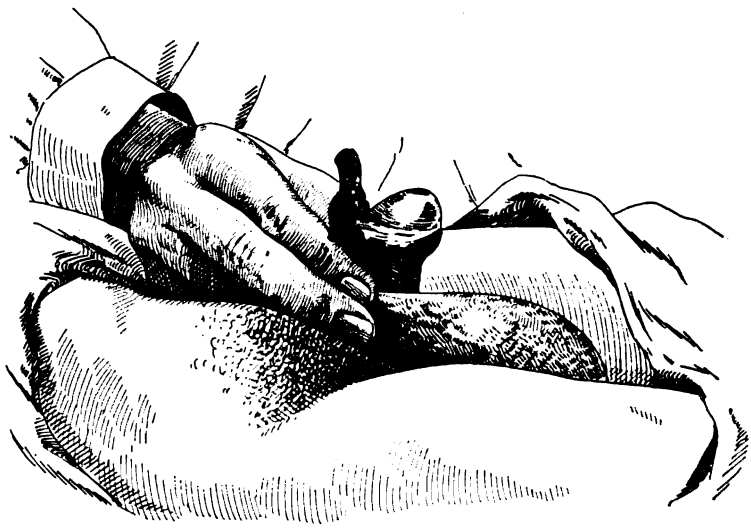


FIG. 19.—Cornu Cutaneum of the Penis.

inguinal regions, besides burning pain from contact of the ulceration with urine. It is remarkable, though, how indolent many patients are, and how far cases are developed when they are shown to the physician.

Differential diagnosis from condylomata acuminata has been mentioned above. The primary lesion, **hard chancre,** might in some early cases come into consideration.

INJURIES AND DISEASES OF THE SCROTUM, TESTIS, EPIDIDYMIS AND CORD.

CONGENITAL DEFORMITIES.

Ectopia of the Testis.

If the testis does not follow the natural route in its descent, the scrotum is empty. The affection may be unilateral, and is then called **monorchism,** or bilateral (much rarer) and is then called **cryptorchism.** In small boys this condition is simply the result of a retardation of the descent, and is of no consequence. With the approach of puberty, when the testis begins to grow and develop, this abnormality begins to produce symptoms. The **gland becomes painful** and there is a **feeling of strain** in the cord, which first is felt only during exercise, and later on becomes constant. The scrotum is not only empty, but smaller than normal.

Where testis is found.

In by far the greater number of cases the testis can be felt in the **inguinal canal,** where the usually small organ, more ball-shaped than normal, is either **fixed or movable.** In the latter case it evades the searching finger, owing to its extremely smooth surface. If the testis disappears quickly in the inguinal canal on palpation, the affection may be mistaken for a **reducible inguinal hernia.** It may be mentioned here that **monorchism is frequently combined with congenital hernias.** The reversed mechanism is possible too, *i.e.*, the organ may at the moment of examination lie in the ring, and on coughing give an impulse like a hernia. The **tenderness on pressure of the testis** is an important differential point. If ectopia is unilateral, the general development of the patient is not impaired; if bilateral, the virile habitus is lacking in regard to voice, beard, frame, pelvis, etc.

Differentiation.

Besides hernias, **hydroceles** are a frequent combination.

In some cases the non-descended testis becomes **incarcerated,** and then produces symptoms very similar to those of strangulated hernia.

Another complication is **torsion of the cord,** which produces symptoms similar to those of twisted ovarian cyst.

Other forms of ectopia.

Besides inguinal ectopia, which, as said above, is by far the most frequent, other forms have been observed, as **ectopia subabdominalis,** where the testicle, after leaving the outer inguinal ring, wanders under the abdominal skin upward. The **ectopia cruralis** is the form in which the displaced organ is found at the point where femoral hernias occur. Finally, the **perineal form** is not so very rare, and is important, as the organ is more exposed to insults.

It is important not to mistake ectopia for hernia, because patients then usually wear a truss, and thus not only serious discomfort and pain are liable to follow, but also increased atrophy by pressure.

INJURIES AND DISEASES OF THE SCROTUM.

Contusions of the scrotum are usually combined with those of the testis. The skin very soon swells up and becomes smooth and of an intense dark blue or black color, which may spread toward the inguinal region and on the thighs.

Wounds of the scrotal skin offer no peculiarities, except that they call for possibly more attention, as the danger of **infection** seems to be very pronounced.

Inflammations.

A **phlegmon** of the scrotum is usually the result of ulceration of the penis, or of cavernitis, or **urine infiltration;** especially the latter must be recognized at once as an extremely dangerous condition. **Gas phlegmon** develops frequently, and gangrene ensues very quickly.

Elephantiasis of the scrotum may lead to immense deformities, but is more frequent in tropical regions. It is easily recognized by the **tough character of the thickened skin,** with numerous protuberances. If the tumor reaches any size, the penis usually disappears under the skin. In discharging urine, the patient then wets the tumor, and eczema, with its symptoms, is the result.

Tumors.

Of tumors we find principally atheromas, dermoid cysts, and **carcinomas.** The latter occur comparatively frequently, and seem to be due in many cases to a chronic chemical irritation, as from tar, paraffin, soot (chimney-sweeper's cancer).

INJURIES AND DISEASES OF THE TUNICA.

Hæmatoma of the tunica is very frequent. If it is fresh, it shows distinct **fluctuation,** while in later stages, after four weeks or so, it may have solidified, and then may **simulate an incarcerated hernia,** es-

pecially if the hæmatoma reaches up into the inguinal canal. Usually a **hydrocele** of not very large dimensions has been in existence before.

Periorchitis is usually combined with hæmatoma of the scrotum and traumatic orchitis. It leads to an **acute effusion** into the tunica, producing a translucent tumor, sometimes with soft crepitation. **Palpation is extremely painful.** In some cases the contents later become **purulent.** Then the **temperature,** which is elevated in the former cases, rises higher, and the entire clinical course becomes more violent.

Hydrocele.

Hydrocele is either the result of a **trauma,** especially in children, or the sequel of **gonorrhœa,** especially if complicated by epididymitis. Another etiological factor, in children at least, is **phimosis.**

The hydrocele grows slowly, filling the sac of the tunica vaginalis. It usually gives **no symptoms** whatsoever until its size and weight, causing a certain dragging pain, call the attention of the patient to the tumor.

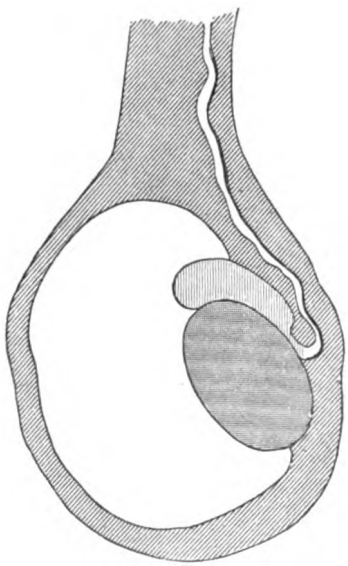


FIG. 20.—Hydrocele.

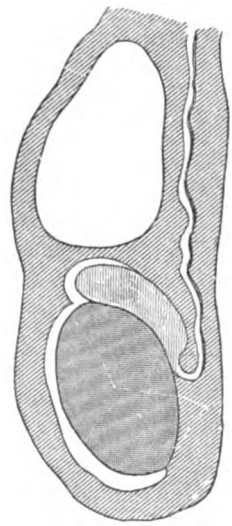


FIG. 21.—Hydrocele of the Cord.

Symptoms.

Inspection shows the affected side (hydrocele is only rarely double) enlarged, the folds of the skin more or less smoothed out, the shape of the tumor long drawn out.

The **tumor is translucent,** which can best be demonstrated by apply-

Translucency.

ing an old-style stethoscope in front, while a small electric light is held behind it in the same axis. To exclude mistakes, the stethoscope must be pressed firmly on the surface.

It has to be mentioned that very soft tumors of the testis may be translucent too.

Palpation shows a tumor of egg or pear shape, of perfectly smooth surface, the skin over it movable. The **proximal end,** shaped like the point of an egg, **is distinctly to be felt** before the inguinal ring, even if there is a hydrocele funiculi spermatici. The **cord is distinctly free,** its consistency tensely elastic. The testis and epididymis are covered by the tumor, and can be felt only if the tumor is under very little tension. Sometimes they can be located by their sensitiveness to pressure.

Cord and inguinal ring free.

In **children** the upper part of the **hydrocele** is open, and **communicates** with the abdomen. In such cases the contents can sometimes be expressed from the hydrocele into the abdominal cavity.

If the hydroceles become very large, they usually by their weight pull down a fold of peritoneum, and this gives rise to a **hernia,** which then exists on top of the hydrocele.

Differential Diagnosis.—Hernia, and for hydrocele communicans, congenital hernia, have to be considered. The above-described **typical symptoms of hydrocele,** where the cord is free, and the end of the tumor can be distinctly felt, are not present in hernia; nor is the latter translucent. Differentiation between congenital hernia and communicating hydrocele is possible, as in the (reducible) **hernia** the contents disappear in taxis with a **gurgling sound. Exploratory puncture (not to be recommended)** shows usually a perfectly clear, amber-colored fluid, generally not sterile.

Hydrocele funiculi spermatici, hydrocele of the cord, shows practically the same symptoms. It also may communicate with the abdominal cavity.

The size usually does not surpass that of a hazel-nut or walnut. If the cyst is very small, it is extremely movable, and may be even apparently reducible into the ring.

For differential diagnosis, we have to consider **spermatocele,** which is usually situated at the lower part of the cord.

Varicocele.

Varicocele is an **enlargement of the veins of the spermatic cord,** parallel to the varices of the leg.

If the veins are much enlarged, multiplied, and elongated, the varicocele finally gives the impression of a soft, elastic, compressible tumor. Like other enlarged veins, they sometimes give rise to the formation of **phlebitic stones,** which can be felt as hard, movable, small tumors.

Varicocele usually develops slowly, only in exceptional cases in a short time. The **principal symptom** is a certain **dragging pain** and a feeling of tension. It is a well-known fact that young patients affected with varicocele frequently are or become sexual neurasthenics. Patients sweat more, which leads to discomfort and eczema. The affection is much more frequent on the left side than on the right, according to the statistics of armies.

Differential diagnosis shows really no difficulty; possibly some forms of varicocele might be mistaken for hernia, as they give, like the latter, an impulse on coughing.

INJURIES AND DISEASES OF THE TESTIS AND EPIDIDYMIS.

Contusions happen quite frequently, especially during swimming (water-polo), horse-back riding, etc., or may be caused by a kick. The **pain is intense,** and frequently leads to loss of consciousness, or faintness, nausea, vomiting, etc. The injury is easily recognized by swelling of the scrotum, as well as of the testis and epididymis. They are both **extremely tender** on pressure; after a few days, dark blue discoloration sets in. Sometimes a **traumatic dislocation of the testis** results, analogous to the manner described under ectopia.

Other injuries offer nothing characteristic, except possibly **cuts, where the seminiferous tubules prolapse.**

Inflammations of the Testis and Epididymis.

They may be the result of the traumas named above, or they are secondary inflammations.

Orchitis, inflammation of the testis, occurs frequently in the course of mumps, typhoid, or other eruptive **fevers.** By far the most frequent cause is **inflammation of the urethra,** especially that due to gonorrhœa, Orchitis.

stricture, prostatitis, or catarrh of the bladder. Usually orchitis is accompanied by a light form of epididymitis.

The testicle becomes **enlarged,** sometimes to the size of a fist, and **very painful,** spontaneously as well as on pressure. **Fever** usually initiates the affection. The epididymis is usually to be felt as a small flat body. If an acute hydrocele has formed, or if the epididymis is considerably inflamed too, the latter cannot be made out distinctly.

Epididymitis.

For **epididymitis** a urethral disease is usually responsible, most frequently gonorrhœa, of which thirty per cent of cases are complicated by epididymitis. It usually occurs between the second and third weeks of the infection, and frequently can be traced to an insult, either too much walking, horse-back riding, or other violent exercise, or too strong urethral injections. It usually **starts suddenly with violent pain** in the scrotal and inguinal region. The epididymis is decidedly enlarged, and can be felt as such, unless an acute hydrocele is present. At the same time there is usually a purulent discharge from the urethra. The **early recognition is important,** as proper treatment may subdue a violent inflammation, which is very frequently **followed by sterility.**

Sterility due to *x*-rays.

In connection with this I might mention that lately a number of cases have been observed, where **azoospermia was the result of exposure of the organ to Roentgen rays,** either repeatedly, as in professional Roentgen workers, or only once, for the purpose of photographing the pelvis, stones of the bladder, etc. So far no preliminary symptoms of this atrophy are known.

Tuberculosis and Syphilis of the Testis and Epididymis.

For practical purposes it is safe to say that if a chronic hyperplastic inflammatory process, which cannot be explained otherwise, is found, we may assume that it is **tuberculosis if in the epididymis,** and **syphilis if in the testis.**

Tuberculosis of the epididymis.

Tuberculosis of the epididymis occurs usually in the years from eighteen to thirty, and shows one, or several, **hard nodules** in the cauda of the epididymis, which quickly becomes enlarged, finally **leading to suppuration** and perforation, with the formation of fistulas. There is usually very little pain connected with it. Later on, the vas deferens becomes infiltrated, and tender on pressure. After a few months, the disease attacks the testis also.

The **diagnosis** has to **exclude acute epididymitis** of traumatic or gonorrhœal origin. The **general condition** is sometimes little impaired,

especially if fever is absent, as it quite frequently is; in other cases the general health is greatly impaired, especially if other tuberculous foci are existing, in the urogenital tract, lungs, glands, etc. Tuberculosis of the epididymis shows great tendency to **involve the seminal vesicles.**.

For **diagnosis during operation,** the tunica as well as the surface of the epididymis, and in later stages the testis, show the typical tuberculous nodules of shiny, whitish, yellowish, or red color.

Syphilis of the testis.

Syphilis usually attacks the testis itself and communicates the disease only in later stages to the epididymis, just the opposite to what occurs in tuberculosis.

The syphilitic affection may be either **hereditary,** occurring in children as well as in men, or a manifestation in the later stages of **acquired** syphilis.

The **testis is enlarged,** sometimes to the size of a fist, **rather hard,** frequently of **irregular surface** and uneven consistency, in consequence of the presence of a number of **infiltrated nodules.** The latter, which are **first harder** than the surrounding parenchyma, may **later on become softer** than the same, if the infiltrations break down.

If the above-named symptoms are present, especially with the history and signs of either acquired or hereditary syphilis, the diagnosis is usually easy.

Solid **tumors,** as sarcoma and carcinoma, **have to be excluded.** This may be somewhat difficult, but usually the tumors grow faster. Eventually, for a short time, probatory **antiluetic** treatment should be tried.

Spermatocele.

Spermatocele.

This is a **cyst** located usually at the **anterior surface** of the testis, or at its upper pole. Frequently it can be felt as a distinct fluctuating tumor **between** the epididymis and testis. Sometimes the wall becomes hard and thickened; nevertheless, fluctuation can be felt through it. The form of the tumor is either oval or spherical.

Exploratory puncture shows spermatozoa in the fluid. They usually have automotion; only rarely they are dead. The fluid may be either perfectly clear or milky, like soap-suds.

Tumors of the Testis.

By far the most frequent form of tumor is **sarcoma.** It may be unilateral or bilateral, and may start from either the testis or epididymis. Frequently a small hard nodule has been in existence for a while, either

observed or unobserved by the patient, when **suddenly** the small tumor begins to **grow quickly.** There is practically no pain connected with the affection. The tumor is usually smooth, sometimes with indistinct nodules on the surface. The consistency depends upon the manner of growth: if it is quick, it is comparatively soft and spongy; if slow, more hard. In later stages the cord becomes affected too. Enlarged inguinal glands, according to the manner of distribution of sarcoma, are frequently not present.

As a **complication, hæmatocele** is very frequent, so much so that if a hæmatocele is found in the examination of a testicle, the suspicion of a sarcoma is justified.

Differential diagnosis must be made from **carcinoma.** This is much rarer and occurs at a later age. The tumors are of a more uneven surface. **Syphilis** may sometimes be difficult to exclude, the more so as the syphilitic anamnesis is so absolutely unreliable. It is claimed that sarcoma usually starts in the posterior parts of the testis and epididymis. The significance of a hæmatocele has been mentioned. Eventual probatory **antiluetic** treatment may be tried.

Tuberculosis shows a tendency to caseous degeneration, and the formation of abscesses and fistulæ; besides, frequently tuberculosis of other organs is observed.

Carcinoma.

Frequency. It is much rarer than sarcoma, and nearly always starts from the testis.

If a (usually single) **hard nodule** develops slowly in the testis, leaving the **epididymis free,** and then suddenly grows rapidly, with an **uneven surface** and rather hard consistency, the diagnosis of **carcinoma** is probable. The **inguinal glands** are soon involved.

For **differential diagnosis,** see the other affections of the testis and epididymis.

I need only mention the other tumors which occasionally occur, fibroma, lipoma, enchondroma, with different mixed forms, especially with myoma and myxoma.

Finally, dermoid cysts and teratoma occur, but extremely rarely. They are always congenital, grow very slowly, are painless, and exploratory puncture shows their typical contents, especially hair.

HERNIA.

The exact knowledge of different forms of hernia is of great importance for several reasons:

1st. Because they are very frequent.

2d. Because a great many hernias, in infants at least, are submitted to the general practitioner for treatment, who otherwise usually refuses to treat surgical cases.

3d. For their many difficult points in differential diagnosis.

4th. From a medico-legal standpoint (so-called accidental acquisition of a hernia).

5th. For the acute and serious danger, which may arise from hernias under certain pathological conditions.

It is usually not sufficient to be able to make the diagnosis, but necessary to recognize also the **anatomical nature** of the hernia, its **contents,** its **reducibility,** and eventually its incarceration or **strangulation.**

Forms of hernia.

The three most important forms are the **inguinal, femoral,** and **umbilical** hernias. Besides these a number of rarer forms are observed. Another form is the internal hernia, and finally we might mention the operative hernias.

While it is absolutely certain that in a great many cases an experienced physician recognizes a hernia with one look and with one touch, only systematic and careful examination of every single case of supposed hernia will prevent occasional serious mistakes.

Common symptom.

All hernias (except the internal hernias) have one common principal symptom, that of an **abnormal tumor-like swelling.** Sometimes this swelling, if very small and in the depth of the abdominal wall, cannot be seen, but can only be felt by careful palpation.

As the contents of every hernia are of abdominal origin, there must be a stem or **pedicle** which connects these contents with the abdominal organs. Under certain conditions this pedicle cannot be felt.

The above-named swelling is not stationary, but **variable in size,** according to the behavior of its contents, spontaneously as well as on pressure. Changes in the size, form, and elasticity of the tumor may

be due to the varying amount of **fæces in the intestinal loop,** to the difference in consistency of the contained fæces, to the presence of **gas,** etc. If the patient uses **abdominal pressure** he may **increase the tumor** by pressing more gut into it. Sometimes even slight manual **compression** reduces the tumor considerably, or makes it disappear altogether. **Violent exercise,** like jumping, heavy lifting, bending over, may influence the tumor, and finally even a simple change in posture may have its effect. Besides bearing down, **coughing** brings out the hernia plainly, and is therefore used for diagnostic purposes. If a hernia is reduced with the patient in a horizontal position, the palpating hand afterwards feels the smooth peritoneal surfaces of the sac rubbing against each other. In many cases it is extremely hard to decide whether a hernia has been entirely reduced. Long-standing hernias very frequently form **adhesions** to the peritoneal sac, which may be exceedingly thin, but dense. Long threads then connect the lowest end of the intestine with some part of the sac, which apparently permit the complete reduction, but will finally pull the hernia down again, in spite of any truss.

Reduction.

The **changes in size** mentioned above, and the **reducibility are the surest symptoms of hernia.** If a hernia is irreducible, it has to be recognized as such by its contents—usually **intestine or omentum.**

Contents of hernias.

Intestine is recognized by its evenly rounded form of elastic, not very tense consistency, by its changing resistance, according to the action of abdominal pressure or varying degree of fulness.

In very large hernias peristalsis sometimes can be observed.

Percussion gives **tympanitic sound** if the gut is filled with air, but dulness does not speak against hernia; it is observed if there is no gas in the intestine. **Intestinal sounds are of the highest importance.** Attempts at reduction produce **gurgling** sounds, and, if finally the hernia disappears, the entire contents go into the abdominal cavity with a **characteristic squashing sound.**

If the contents consist of omentum, partially or entirely, this can be recognized by its **irregular lobuled surface.** The layers between the two examining fingers can usually be thinned out until only one layer is distinctly felt. If the omentum has frequently undergone inflammatory processes, its surface is decidedly **granular.**

Other symptoms

Some hernias for a while give no symptoms whatsoever, and their existence may be unknown to the bearer; but most hernias give some symptoms at certain times. At the time of the formation of a hernia (the

disposition for which is congenital) the patients feel an **indistinct drawing sensation, which culminates in pain.** In some cases peritoneal symptoms, as **vomiting, fainting,** etc., are present. Later on, hernias make themselves felt by **irregularities in defecation.** As soon as there is a slight stagnation of fæces in the hernia, eructation, vomiting, nausea, meteorism, flatulence, and colicky pains occur. This finally produces mental depression.

Still later on the hernia may become immovable, which is the result of adhesions formed between the sac and its contents.

If hernias grow extremely large, so that extensive parts of the peritoneum are drawn into them, the **retroperitoneal organs** may finally be brought down into the rupture. These very large hernias are **not reducible,** not only because they usually form numerous adhesions, but also because the abdomen has adapted itself to its smaller contents, and refuses to receive what formerly belonged there.

Any pronounced rupture is liable to lead sooner or later to **serious complications:**

1st. Coprostasis.

2d. Inflammation, which is a local peritonitis, and,

3d. Incarceration.

Coprostasis. The **principal symptom** of coprostasis is the **gradual increase** in size and tenderness of the tumor. Coprostasis never occurs suddenly. The danger lies in the fact that the patients are accustomed to irregularities in defecation, and become careless. Finally **meteorism, colic, nausea, and vomiting occur,** but usually the nausea preponderates. There is no acute aggravation, until well developed peritonitis sets in. The **vomiting** may finally assume a **fæcal** character. Palpation usually shows the presence of doughy masses in the hernia.

Inflammation. An inflammation of a hernia may either be simple local peritonitis, induced by migration of bacteria through the gut, or be due to inflammations of the gut itself, like typhoid, tuberculosis, and appendicitis.

In recent years quite a number of cases of acute appendicitis have been found in hernias, a matter easily understood, if we know that **exceptionally long appendices quite frequently enter hernias.**

Strangulation. The most serious complication is the incarceration and strangulation of a hernia. In most cases the afferent and deferent sections are completely occluded. The contents of the gut cannot be expressed by outside compression. The strangulation, in a very short time, **produces dis-**

turbances of the vascular supply, and it becomes plainly necessary to recognize a strangulation early when we realize that **extensive gangrene** of an incarcerated loop **can develop within ten hours.** The history of an incarceration is usually as follows:

Its symptoms. A middle-sized hernia, always reducible hitherto, suddenly after some extra exertion **becomes irreducible,** a fact which is nearly always noted by the patients themselves. **Immediate violent pain** locally, as well as over the entire abdomen, is experienced, and usually the patients soon have a strong desire to defecate. A decided oppression exists, and **nausea and vomiting** usually occur very soon after the pain sets in. The vomit, first representing only the contents of the stomach, becomes more copious and is mixed with bile. It is of exceedingly **bad odor** and finally muddy **greenish-brown masses of a decided feculent character are ejected in a characteristic way,** *i.e.*, the masses flow over, so to speak, without any apparent effort of the patient. In the later stages the patients appear exceedingly ill; restlessness, great anxiety, etc., are apparent. The **pulse,** first hard and strong, becomes feeble and frequent, the **respiration** superficial, and extremities cold. Peritonitis sets in with all its symptoms, especially the anxious expression of the face. These are the symptoms if the case is well pronounced.

If we have to deal with a so-called **Littre's hernia,** which is an incomplete hernia of only a part of the wall of the gut, the symptoms may be much less violent, as can be easily understood for anatomical reasons. But for that very reason they can be very easily overlooked.

Diagnosis The diagnosis of strangulated hernia can be difficult only if the patient is unaware that he has a hernia, and if the hernia is very small. It may be mentioned here that it is usually not the **very large hernias** that **show a great tendency to incarceration,** but the **smaller** and smallest **kinds are** really **more dangerous.** Sometimes, especially in the case of Littre's hernia, the hernia becomes strangulated at the moment it forms, and any anamnestic data then, of course, are absent. Generally, however, anamnesis is of some value; where it is not of much help, careful examination is necessary. Besides, we must not forget that **several hernias can exist at the same time,** one of which may be strangulated.

If in examination for strangulated hernia a tumor can be felt and found, it is irreducible; therefore an otherwise characteristic symptom of the hernia is absent.

As stated above, **every hernia must have a pedicle** leading into the abdominal cavity, which in most cases can be felt.

The tumor is tender on pressure and usually of even, tense consistency. Percussion, as stated above, is frequently of no value.

Obstipation is not necessarily a symptom, as quite frequently the contents of the lower part of the bowel are still evacuated in the beginning, even wind may be passed for a short while. The smaller the tumor, the more difficult the examination, and the more probable are mistakes.

Differential diagnosis from **inguinal glands** with acute inflammation may sometimes be difficult. Only a very short period of observation is permissible for final decision. The **use of opiates** is decidedly **undesirable,** as it is apt to blur diagnostic points of importance. Differential diagnosis.

The same symptoms, of course, may exist without any **external** strangulation in cases of internal incarceration.

If omentum forms the contents of the hernia, instead of gut, the symptoms of acute incarceration are much less pronounced. If there is strangulation of both gut and omentum, the symptoms may, of course, be the same as if the bowel alone were present.

Inguinal Hernia.

The study of hernias proves again what has been said in the introductory part, that simple objective observation cannot lead to a proper diagnosis. A complete theoretical knowledge is necessary; we must know what we may have to expect to find, to be able to interpret our observation. It is impossible to give within the scope of this book the entire anatomy and mechanism of the different hernias, without the knowledge of which an exact differential diagnosis of hernia from other similar swellings is impossible, as well as a differentiation between the varieties of ruptures.

All **inguinal hernias** finally **appear under the skin at the outer inguinal ring,** but there are two different ways for them to get there. One, the so-called **indirect hernia,** and by far the more frequent form, occurs when the **peritoneal sac** with its contents, on leaving the peritoneal cavity, **enters the internal ring,** situated above and outside the external ring. The hernia then **follows the inguinal canal,** which is oblique, running from above and externally downward and inward, and finally appears in front of the external ring. In these cases the entire cord and the vas deferens accompany the hernia. **This typical form is followed by all congenital inguinal hernias.** (Fig. 22.) Manner of formation of inguinal hernias.

If a congenital hernia is of long existence, the inguinal canal, which

Congenital inguinal hernias.

extends over a length of three inches in perforating the thin abdominal wall, becomes straightened and shortened so that the **inner ring,** formerly considerably to the outer side of the external ring, comes very much nearer to the mesial line, until it is situated nearly **directly behind the outer ring** (in a sagittal direction). This form approaches very nearly the so-called **direct inguinal hernia,** where the perforation of the abdominal wall is straight and short. It is easy to understand, that in those cases the vas deferens goes its own way through the oblique inguinal canal, and meets the hernia only at the outer ring. Therefore

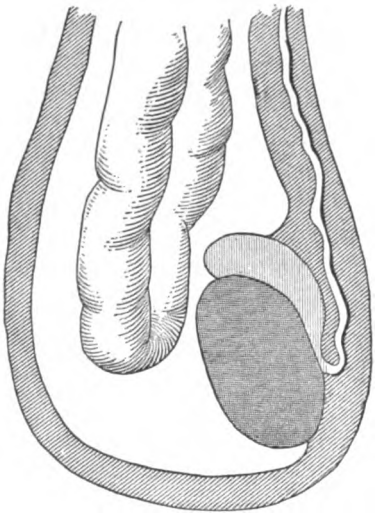


FIG. 22.—Congenital Inguinal Hernia with Slight Hydrocele.

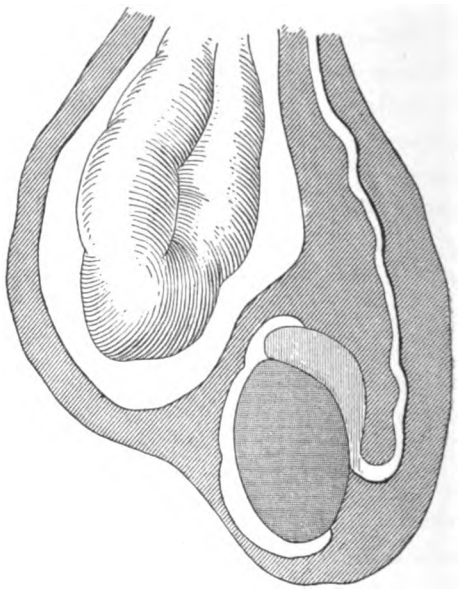


FIG. 23.—Acquired Inguinal Hernia.

the **isolated vas deferens can be distinctly felt** in those cases **separately from the hernia.** This is a **much surer sign** than the relative position of the epigastric artery, which is very hard to feel.

The entire course of an inguinal hernia can be felt and followed, if the hernia is reducible, with the finger, the same being inserted at the lowest point of the scrotum or labium, and carrying the scrotal skin before it through the canal.

The **different grades of inguinal hernia** may thus be described:

1st. The inguinal ring is permeable for the finger. If at the inner ring the introduced finger feels the impulse of the peritoneum during

coughing, we speak of **predisposition to hernia.** This constitutes no barrier to service in any army of the world.

2d. The hernia usually does not enter the canal, which is generally empty, and does so only during coughing and defecation. If the abdominal pressure ceases, the contents of the inguinal canal retract again **(hernia inguinalis incipiens)**. Men with such anatomical conditions are bound to develop a complete hernia, if they are submitted to violent exertion.

3d. The **incomplete or interstitial hernia** fills the entire canal at all times, but does not appear as a tumor outside of the outer ring.

4th. The **complete hernia,** or bubonocele, forms a distinct tumor in front of the external ring.

5th. The **scrotal hernia** reaches down into the scrotum (labial hernia in women).

6th. The scrotal hernia becomes so large that the larger part of the intestines lie outside of the abdomen in the scrotum.

Differentiation between **congenital and acquired** hernia is not always easy, sometimes impossible; but generally speaking, in **congenital** inguinal hernia the **testis is in the same sac** with the hernia. In acquired hernia each has a separate cover. It is of importance to **make the differential diagnosis,** if possible, **before the operation,** as it may become necessary to **castrate on the side of the hernia** to achieve a complete result. For this, of course, the consent of the patient has to be given in advance. In a great many cases, though, it is impossible to make the diagnosis between congenital and acquired inguinal hernia. For the latter the definition is generally acknowledged, that the **acquired hernia is formed after the vaginal process has been closed** (after the descent of the testis), the peritoneum pouching into the fascia infundibuliformis and descending into the scrotum, following along the cord. Differentiation.

Cryptorchism and hydrocele exist very frequently, with or without inguinal hernias of congenital or acquired character, and may make the diagnosis difficult by their complications. The accompanying pictures (after Graser) explain the various combinations.

We have still to mention that an inguinal hernia, as well as a hydrocele funiculi spermatici, may assume the form of a dumb-bell, where **one-half is outside the inguinal canal, the other inside.** If the communicating hole is very small, so that the dislodgment of the fluid from the outer into the inner sac is slow, these conditions may be mistaken for an inguinal hernia hard to reduce. Dumb-bell shaped hernia.

Besides direct inguinal hernia, which I have mentioned above, where the cord and vas deferens are to one side of the hernia, we find the so-called properitoneal inguinal hernia, also called **interparietal.** This is frequently combined with an inguinal hernia, and is really a variety of

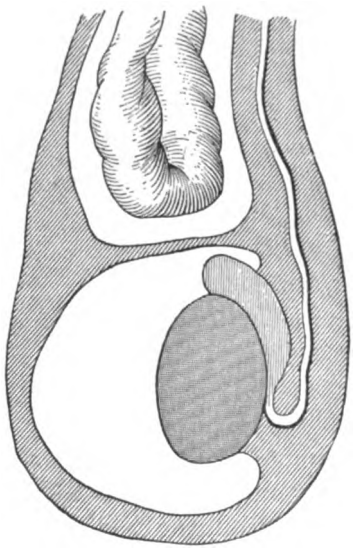


FIG. 24.—Vaginal Hydrocele with Acquired Inguinal Hernia Above.

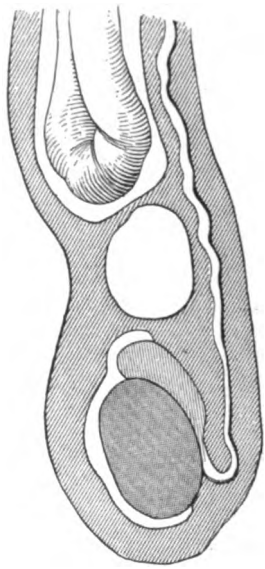


FIG. 25.—Hydrocele of the Cord with Acquired Inguinal Hernia Above.

it. The rupture **perforates the abdominal** wall in the region of that little **fossa,** which is situated **between the bladder and the lateral vesico-umbilical fold.** The hernia then leads in an oblique direction laterally, and appears under the skin at the outer ring, or to the side of it. The **bladder,** or rather a part of it, is frequently found in this form of hernia. Forty per cent of the properitoneal hernias are combined with cryptorchism. This form is rather rare, but of unusual interest.

Frequency.

The inguinal hernias occur four times as frequently in men as in women. In men the right side is three times as frequently affected as the left. In women both sides seem to be equally affected.

Inguinal hernias in women show the same characteristics as in men. The hernia descends into the **labium,** instead of the scrotum. They have less tendency to become large than in men, and show less tendency toward incarceration. In connection with this, we might say that, generally speaking, the large hernias less frequently show incarceration than the small ones, a fact which is easily understood.

One word might be said about **taxis.** It is generally acknowledged to-day that taxis is **permissible** only **as a diagnostic procedure,** but not as a therapeutic one. Usually the patients themselves do all that is permissible in the line of taxis, and more, and as soon as a hernia shows any resistance to reposition, all further attempts should be given up.

For differential diagnosis we have to consider the following: Excluding inguinal glands, which ought not to be mistaken for hernia, we have three possibilities: Differential diagnosis.

1st. Either we have a hernia (or the dumb-bell shape hydrocele communicans mentioned above), or,

2d. We have a swelling pertaining to the tunica of the testis or cord, or,

3d. It is a solid tumor of the testis or epididymis.

1. If it is a **hernia** (or a hydrocele communicans) the swelling **has a pedicle** leading into the abdominal cavity. This pedicle runs **above** Hydrocele communicans.

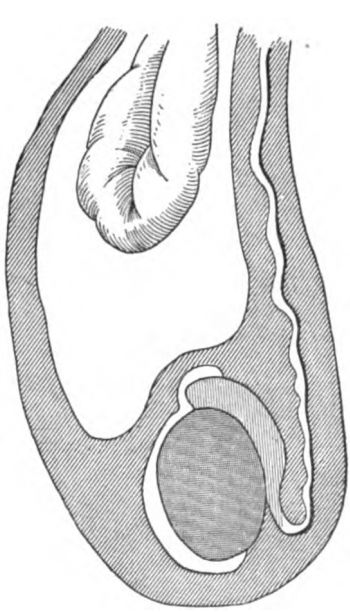


FIG. 26.—Acquired Inguinal Hernia with Hernial Hydrocele.

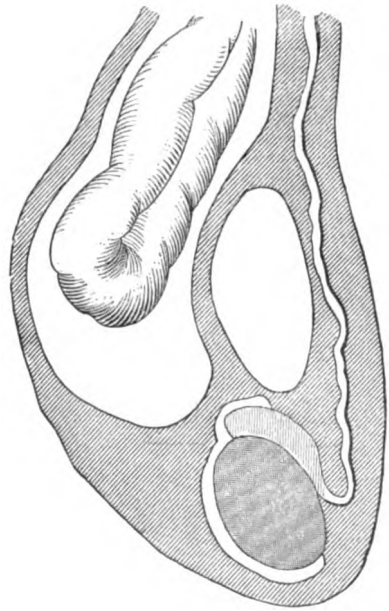


FIG. 27.—Acquired Inguinal Hernia in Front of Hydrocele of the Cord.

Poupart's ligament. **Percussion** over the swelling, if tympanitic, indicates with certainty a hernia. If dulness is present over the anterior part and tympany over the posterior, we have omentum as contents,

besides gut. If the entire **swelling shows dulness,** we have to deal either with an omental hernia or a hydrocele communicans. If the **swelling is reducible,** we feel in hydrocele communicans a trickling as of water; in omental hernia, after partial reduction, distinct strings and granulated lobules of the omentum. In hernias with gut as contents, or gut with omentum, we hear and feel the characteristic sound.

Light-test. To **differentiate** hydrocele communicans from hernia, we fill the outer sac of the hydrocele to its utmost by pressure from above, and then

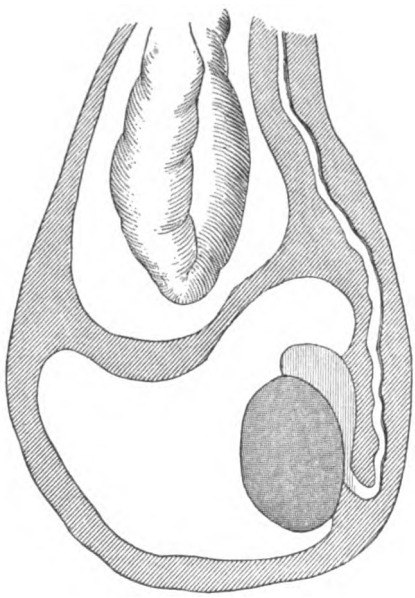


FIG. 28.—Acquired Inguinal Hernia Protruding into a Vaginal Hydrocele.

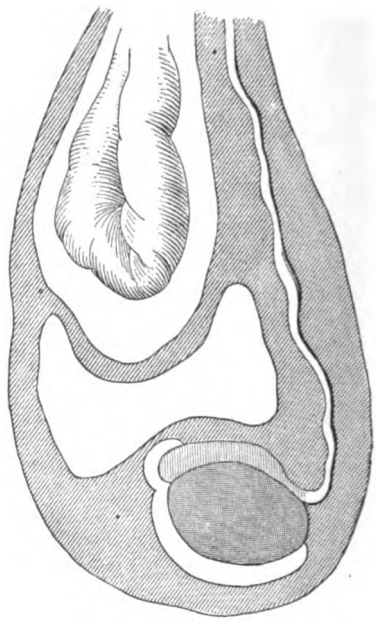


FIG. 29.—Acquired Inguinal Hernia Protruding into a Hydrocele of the Cord.

apply the usual light-test. Behind the compressed and somewhat elevated scrotum a light is placed, preferably a small electric light so as not to burn the patient, opposite which we place in front of the tumor an old-fashioned stethoscope; the **hydrocele then proves translucent;** except when the sac is unusually thick, we see a red disk.

The **testis** can usually be made out easily, according to its **tenderness on pressure,** except in very dense congenital hernias, where the testis is inside the hernia sac; but then the **vas deferens** can usually be easily felt at the lower pole of the hernia.

2. If the swelling belongs to the tunica, the principal symptom is:

the **cord is free,** there is **no pedicle** to the tumor. If in bilocular hydrocele (*en bissac*) there is a spur leading up into the inguinal canal, its rounded end can usually be felt; even if not, **fluctuation,** which can be felt in practically every hydrocele, can also be detected in its upper half. If the hydrocele is under very high tension, fluctuation is harder to feel, but if properly tested for is hardly ever absent. It ought not to be necessary to repeat what has been said in the Introductory Chapter (cf. page 10) about how to feel for fluctuation, and I refer to that part, and merely call attention to the fact that fluctuation can be made out with certainty only when the technique is properly executed. Swelling of tunica.

A hydrocele (*en bissac*) may be emptied partly into the upper part, but never entirely. The **hydrocele is translucent and is not influenced by abdominal pressure** (coughing, etc.). It must not be forgotten that the **combination of hydrocele with hernia** is quite frequent, but careful examination should disclose this condition.

Exploratory puncture is absolutely forbidden, as it might be fatal if we have to deal with a hernia, and if we know the tumor to be a hydrocele, where only it would be permissible, we do not need it.

3. Tumors of the testis or epididymis have (except where the neoplasm starts from the cryptorchidic testis) a **free space,** where only the cord can be felt, between the external ring and the tumor. The swelling is **not fluctuating,** or at least only partly so (in case of cystic degeneration or combination of the tumor with a hydrocele); it is **not translucent,** and is quite heavy. Tumor of testis or epididymis.

The differentiation of the different forms of tumor occurring in the testis and epididymis is discussed under that heading.

Femoral Hernia.

Unlike the inguinal canal, which exists in all individuals, a **femoral canal does not exist** physiologically **until a femoral hernia is formed.** The femoral hernia enters from the abdomen into the foveola cruralis or obturatoria, and **appears below Poupart's ligament** at the mesial side of the vessels. The hernia is usually easily recognized, and only inguinal glands situated below Poupart's ligament might be mistaken for it. The size of femoral hernias is usually not very great, and they attain excessive dimensions only rarely.

Inguinal and femoral hernias may be mistaken for other things or for each other, and I therefore mention a few more differential diagnostic facts. Differential diagnosis.

Besides hydrocele and tumors, other conditions may be mistaken for inguinal hernia, as orchitis, varicocele, enlargement of the testes, and tuberculosis of the testes.

Enlarged lymphatic glands and even acutely inflamed glands can be mistaken for incarcerated femoral hernia. Besides this, abscess in the pubic region, varix of the saphena, and psoas abscess may lead to an error in diagnosis.

For **differentiation between inguinal and femoral** hernia, we must remember that all congenital and nearly all hernias in early life (within the first decennium) are inguinal hernias.

Whatever appears **above Poupart's ligament** is inguinal hernia. If the hernia is reducible, the inguinal canal can be followed with the finger in men.

Femoral hernias only very rarely go above Poupart's ligament, but, on the other hand, **inguinal hernias in old women** descend sometimes toward the femoral region. The **pedicle of the femoral hernia is short** and has a sagittal direction; that **of an inguinal hernia is long** and ascends obliquely upward and outward.

The differentiation between congenital and acquired inguinal hernia is sometimes impossible, often difficult, and rarely ever of practical importance.

The examination in these cases should be conducted on the following diagnostic lines:

EXAMINATION OF HERNIAS.

(According to Bergmann.)

Examination of hernias (according to Bergmann).

1. **Anamnesis.**—Hereditary disposition? Since when has tumor been observed? Since birth? When since? How did it begin? Suddenly? Gradually? With or without pain? Cause of its formation? What was first noticed? Growth of tumor from below upward, or from above downward?

Trauma: Bruise? Overexertion? Fall? Cough? Difficult defecation? Pregnancy? Birth? Further development of tumor? Rapid or slow increase?

What troubles did the tumor cause at first? What now? Indigestion, difficult defecation? Pain localized or diffuse, spontaneous or on pressure?

Pain depending on position of body, motion, taking of food?

2. **Status.**—In which region does tumor occur? Relation to Poupart's ligament; to the tuberculum pubicum; to the os pubis? If in scrotum, on which side?

Size and form of tumor? Spherical, cylindrical? Pear-shaped, hour-glass shaped? Smooth? Knobby? Uniform? Indentations?

Has the tumor a pedicle, or is it freely movable? How far can it be moved; can its boundaries be defined? How thick is the pedicle; where does it lead? In which direction does it extend?

Is the size of the tumor always equal or does it change with change of position (standing and lying down)? In the morning and evening? Does coughing, bearing down, or shouting, make any change in size and tension of tumor? How is the integument affected? Is the skin normal, wrinkled, stretched, scarred, œdematous, reddened, thickened, movable, or adherent? Can it be picked up from the underlying tissues?

Careful examination of the tumor; consistency: soft, stretched, tense, elastic, fluctuating, compressible? Uniform or not? Weight: heavy, light?

Can any organs be felt within the tumor (especially in scrotal tumors, the testis, epididymis, cord, tunica vaginalis propria)? (If the normal organs cannot be felt in tense scrotal tumors, we may assume a swelling of the tunica vaginalis propria.) Position and relation of testis and cord (or of the ligamentum uteri rotundum) to the tumor?

Is there ectopia of the testis? Where does the latter lie?

Can the tumor be divided by pressure into two portions?

Can certain organs be felt in the contents of the tumor? (Intestine, omentum, ovary, bladder?)

Percussion (avoid simultaneous sounds of abdomen and organs). Auscultation (intestinal sounds spontaneously or on pressure). Examination for transparency. Eventually exploratory puncture.

Can the tumor be reduced, eventually made to disappear entirely or partially by pressure, slight or considerable, continuous or short? Where does it go? In what direction? and by what path? Suddenly or gradually? With a noise (gurgling, squashing, trickling) or silently? What remains? (Were the testis and its envelopes replaced at the same time?)

Was the reposition accompanied by pain?

Can the finger follow the path taken by the contents during reposition (by doubling the skin inward)? How is the remaining sac? Is it movable?

Can a hernia ring be felt? Its anatomical situation? Width, boundaries, neighboring parts?

Does the finger penetrate the free abdominal cavity? or does it find an organ in the depths?

Is reposition accompanied by disagreeable symptoms (nausea, fainting, pain)?

Do the replaced contents of the tumor remain in the abdomen if patient is quiet, or do they immediately return? Or do they return when patient rises, coughs, bears down? Entirely or partially?

Can the path of the tumor in its return be accurately traced?

Alternate compression of the inguinal canal, of the outer inguinal ring, of the outer femoral ring in coughing.

If the tumor cannot be replaced, do the contents show a distinct connection with the abdominal cavity?

Can a cause for the impossibility of reposition be established?

Adhesion in the form of a cord? Too great tension in the abdominal cavity?

Does hernia show signs of strangulation or inflammation?

Umbilical Hernia.

There are three different kinds of umbilical hernia:

1st. The congenital hernia of the umbilical cord (ectopia viscerum).

2d. The umbilical hernia of small children.

3d. The umbilical hernia of adults.

1. **Ectopia viscerum, or congenital hernia of the umbilical cord,** is practically of only pathological and anatomical interest, as most of the children thus affected die a few hours after birth, or very soon after.

2. The **umbilical hernias of children** are either the result of a congenital disposition to such a formation, or are brought about by unusual tension of the weak spot where the umbilical vessels entered, as, for instance, by whooping-cough or similar conditions.

Symptoms. The **principal symptom** is a (usually small) **swelling near the umbilicus,** which becomes **adherent to the skin.** The contents are, up to the sixth year, small intestine, and only later on omentum, which before that time is usually too short to reach into the hernia. There is generally little discomfort connected with these hernias, except a quite frequent **ulceration of the skin.** The early recognition of the rupture is of importance, as the ring with a proper support usually closes, and thus does away with the hernia. As these hernias become very soon adherent to the skin, they usually give symptoms only after they have been apparently reduced.

3. **Umbilical hernias in the adult** are mostly observed in women, especially **fat women,** while they are very rare in men or lean women. The contents are usually omentum, and for that reason these hernias frequently do not cause symptoms enough to be brought to the notice of the physician until they become incarcerated.

The statistics gained so far show comparatively bad operative results only for the reason that these hernias are usually not operated on until

they have either become incarcerated, or have grown to immense size. If the hernia is recognized in early girlhood, the patient ought not to be permitted to carry the condition over into full-grown womanhood, with all its danger to the abdominal walls brought about by pregnancy, etc. As the tumor is exposed to constant insults by friction of the skirts, the **overlying skin becomes inflamed,** and error in diagnosis is then practically impossible.

Character of umbilical hernia.

The **pedicle** of an umbilical hernia is usually **round,** and very frequently quite **broad,** so that after reduction sometimes the entire fist can enter through the ring. The **hernial sac** itself is more frequently than not **subdivided into a number of pockets,** some of which may become occluded, so as to form cysts. While the **usual content** of a large umbilical hernia **is omentum,** sometimes intestines are found besides, a small loop of which may become incarcerated in one of the small side pockets.

Prognosis of operations.

In very large hernias the prognosis of operation is comparatively poor; **ten per cent of mortality** does not appear too high. This is principally **due to the condition of the patients,** who are all unusually fat. As to **recurrence,** the result depends principally upon whether the course of healing is aseptic or not. If suppuration takes place the hernia recurs in fifty per cent of the cases; if primary union occurs the percentage of recurrences is seven to thirty, according to the size of the hernias.

Other Forms of Hernia.

The other forms of hernia are extremely rare in comparison with the three kinds named above, but are of importance if the question of **ileus** comes up. Before we decide for an internal obstruction of the gut, we have to convince ourselves that none of the **following rare forms of hernia** exist. They hardly ever come under observation, except when incarcerated:

1. Hernia obturatoria.
2. Hernia ischiadica.
3. Hernia perinealis.
4. Hernia lumbalis.
5. Hernia ventralis, including operative hernias.
6. Hernia diaphragmatica.

Hernia obturatoria.

1. The **obturator hernia** leaves the abdomen through the canalis obturatorius with the obturator nerve and vessels, and **appears directly under the edge of the pubic bone** in a triangle, which is formed above by

the pubic bone, inwardly by the adductor longus, outwardly by the femoral artery.

The examination is best made with the **thigh adducted and rotated outward,** so that the pectineus as well as the adductors and iliopsoas are relaxed. As the **hernia is covered by the pectineus** muscle, and is usually quite small, distinct palpation of the tumor may be difficult, and we have to rely on **localized tenderness on pressure,** which is always present in incarcerated hernias.

Romberg's symptom.

Besides this, another **symptom is important,** the so-called Romberg's symptom, viz., **disturbances in the region of the obturator nerve.** They consist in **piercing pains,** especially along the mesial side of the thigh, **feeling of numbness,** with loss of sensibility and even **paralysis** of the respective muscles. The thigh is usually flexed and cannot be adducted, and all motions increase the tenderness. But one must know that this **Romberg symptom is not exclusively produced** by obturator hernias, but may also be produced by other diseases, as osteomyelitis of the pubic bone. Besides these symptoms we find, of course, all the symptoms of incarceration.

Hernia ischiadica.

2. The **ischiatic hernia** leaves the abdomen through the **foramen ischiadicum,** either above or below the piriform muscle, usually above.

The **diagnosis is exceedingly difficult,** as the small hernia is covered by the massive gluteal muscles. **Abscesses, cystic tumors, and lipomas** may come into consideration for **differential diagnosis.**

Hernia perinealis.

3. The **perineal hernia,** which leaves the pelvis through its muscular floor, **rarely appears in the mesial line of the perineum,** but usually on one side, between the anus and the tuber ossis ischii. It is **extremely rare,** only about forty cases in all being known. The diagnosis is not so very difficult, if one thinks at all of the possibility.

Case.

I, personally, have seen one case, where all the symptoms of acute incarceration suddenly appeared in a man who immediately went to the hospital to see me, and careful examination showed a tumor about the size of a walnut between the anus and tuber ossis ischii of the right side. While everything was being prepared for operation, extreme knee-chest posture was tried for an hour, with copious high oil enemas, which brought about self-reduction, after which all the symptoms of nausea, vomiting, collapse, etc., immediately disappeared. The patient recovered.

Hernia lumbalis.

4. The **lumbar hernia appears through Petit's triangle,** which is formed by the crista ossis ilii, the latissimus dorsi, and the obliquus ex-

ternus. The base of the triangle is formed by the crista, the apex is directed upward. The triangular space is not constant, but exists only where the muscles are not developed very broadly. The hernia is either **congenital,** or preformed in such a way that comparatively slight exertion may make it complete, by pressing abdominal contents into it; or there exists only a weak spot, through which a hernia may be forced under high pressure or traumatic conditions.

Both sexes are equally affected. Like all other rare forms of hernia, they come under observation only when they are strangulated, and attention is called to them by the general symptoms of incarceration.

The **differential diagnosis** ought not to be very difficult, although a number of such hernias have been mistaken for tumors, ileus, and even spina bifida. In nearly all cases which have been diagnosed correctly, reposition has been effected by taxis.

5. The **ventral hernias,** κατ' ἐξοχήν, are **hernias in the anterior abdominal wall,** produced by a pathological weakening of the same, as by abscesses which finally break through the skin, or by operative trauma In the latter case, they appear where primary union has not taken place. The **scar** of secondary union, very dense at first, **stretches** later on, and gives rise to the formation of a hernia, but the real cause is the maladaptation of the peritoneum, and the conglutination of the intestines. We see these hernias very frequently where would-be surgeons, afraid of their inadequate asepsis, do not dare to close the abdominal wound, but drain. These hernias cannot be mistaken for anything else, except possibly a cold psoas abscess, as the result of caries of the spinal column, may assume the form of such a hernia. Hernia ventralis.

The hernias of the linea alba are **produced by stretching** of the interwoven crossed fibres **of the aponeurosis** of both sides. Those **below the navel** are true hernias of the linea alba, and occur most frequently during pregnancy; but in spite of the fact that the recti very frequently diverge quite considerably, a real hernia in the mesial line below the navel is quite rare. **Incarceration of these hernias is extremely rare,** as in all cases where the ring is very wide. A special kind of hernia in the mesial line is **epigastric hernia,** which appears in the mesial line between the sternum and the umbilicus, usually nearer the former. These hernias have been, and may be, mistaken for small **lipomas,** a fact which is excusable if we know that they are primarily epigastric hernias of small fat lobules, which are probably the residuum of the fat surrounding the ligamentum suspensorium. Frequently those fat lobules draw after Hernias of the linea alba.

them a peritoneal fold, but even if such is not the case, the hernias may give the clinical symptoms of incarceration. These hernias are not very rare, and might be easily overlooked on account of their unusually small size. They are always exactly in the mesial line, and a **diagnostic error,** mistaking one for a lipoma, might, under certain circumstances, be fatal if extirpation should be attempted, as they always communicate with the peritoneal cavity. When the bearer is in the horizontal position, these hernias are very frequently invisible.

Symptoms.

The symptoms are rather indistinct. Patients complain of a **general nervous depression,** and inability to attend to any intellectual or physical work. They complain of **digestive disorders,** meteorism, eructation, nausea, vomiting, and pain in the stomach. Frequently they are treated for stomach disease. After meals, violent exercise or bending backward of the trunk, the **symptoms are more pronounced.** During menstruation in women they are also more acute. If these hernias have been recognized as such, **operation** is to be recommended, although the symptoms of pseudo-incarceration usually do not subside until quite a while after.

Hernia diaphragmatica.

6. The **diaphragmatic hernias** are either **congenital or traumatic.** If congenital, they are usually such pronounced malformations that the children die soon after birth.

Whether diaphragmatic hernias without congenital preformation can be acquired during life, with a traumatic tear in the diaphragm, is exceedingly doubtful. If the tear is on the **left** side, it frequently gives rise to the formation of a hernia with symptoms of incarceration. On the **right** side it may cause no symptoms at all. Most frequently the stomach, or a loop of small intestine or transverse colon, enters through the tear into the thoracic cavity.

The **symptoms of a tear in the diaphragm** are rather indistinct, but we have to think of it, if an injured person has fallen from a very great height. Of **local symptoms** we see that, where abdominal organs have entered the thorax, there is, of course, no breathing sound; on the other hand, the constriction of the prolapsed organs produces **uncontrollable vomiting.** These hernias are extremely rare, and even if properly diagnosed offer a **very sombre prognosis,** because of the seriousness of the injury, although a number of cases have been reported where surgical interference saved such patients.

Rectocele.

Another form of hernia, which calls for brief mention, is rectocele. Each rectocele, or prolapse of the rectum, **forms a hernial sac for other parts of the intestine,** as it takes the vesico-rectal or urethro-rectal peri-

toneal fold down into the prolapse. This peritoneal sac very frequently is filled with small intestine or colon, as has been observed in a number of operations. In fact the question has been raised, whether this form of peritoneal hernia is not the primary affection, producing secondarily the prolapse of the rectum.

INJURIES AND DISEASES OF THE UPPER EXTREMITIES.

INJURIES AND DISEASES OF THE SHOULDER.

Injuries of the Shoulder.

Before describing the symptoms of fractures and dislocations of the upper extremities, I would say a few words regarding the examination of fractures and dislocations in general.

Examination of fractures.

For the diagnosis of fracture, **simple inspection is of more value** and less exercised than any other method of examination, but one has to know what to look for, and how to interpret what is observed.

If a bone breaks, its continuity is interrupted. The **fragments** either are in an **abnormal position** into which they have been brought by the influence of the fracturing force, or they assume afterward an abnormal relative position toward each other by the action of the muscles attached to the bone. This action of the fragments produces, first, a so-called **deformity,** *i.e.*, abnormality in configuration, which becomes apparent on comparison with the sound side, and, secondly, very frequently a **shortening.**

Characteristic deformities must be known.

The **deformities** for the different classical fractures (and dislocations) are **typical,** and must be known to the physician. To acquire this knowledge, each single case must be studied with great care, if possible under the guidance of somebody who is more familiar with these injuries. After a few cases have been observed really thoroughly one will be surprised how much can be seen and learned by mere inspection, if one knows what to look for.

The **diagnosis of fractures is gained** in the following way:

1st. From the history of the case (if possible).

2d. By inspection, deformity and shortening.

3d. By inspection combined with palpation, abnormal mobility (the most important sign of a fracture).

4th. By palpation, crepitation.

5th. Of less importance are hæmatoma at the seat of the fracture, pain, and impairment of function.

6th. A most important aid in the diagnosis of a fracture we have now in the use of the Roentgen rays, inspection of the fracture with the screen as weli as photographs. The simple **inspection with the screen** usually is rather unsatisfactory, besides it does not provide us with a permanent record. The **reading of a photographic plate** produced by Roentgen rays is not always easy, and is a matter of experience. Whenever feasible, we should not forget to photograph at the same time, in the same position, the **sound side** for comparison. Many unexpected, but normal, shadows will thus not be misconstrued for abnormalities. In reading the photograph we get the best result by **studying the plate,** not a print. It is transilluminated by electric lights placed behind the plate, which forms the front lid of a dark box. In making a photographic print, many of the finer details are lost, and still more are lost in the attempt to reproduce such a print, which explains how little these illustrations in books really show, in comparison with the original plate. The examination by *x*-rays should not be made until **after all other methods are exhausted,** so that the examiner is fairly familiar with the nature and extent of the injury; then misreadings of Roentgen pictures will less frequently happen. To avoid mistakes it is in most cases necessary to take two pictures, in profile and front view.

How to read *x*-ray photographs.

1. **Anamnesis.**—The anamnesis is of importance, to find out if we have to deal with a **traumatic** fracture, or with a **spontaneous** fracture. The latter occurs either really spontaneously, that is, without the influence of any outer force, or is brought about by such slight force as would not be sufficient to break a normal bone. The **fragility of the bones,** which makes spontaneous fractures possible, is either the **result of tumors** (sarcomas, carcinomas, echinococcus cysts, etc.) or **inflammatory changes** of the bones (osteomyelitis, tuberculosis, syphilis, rickets, osteomalacia, etc.). The **latter,** especially, is the result of **chronic poisoning** with a number of substances, such as morphine, lead, arsenic, etc. If the architectural structure is thus changed by a disease, all mechanical laws, where and when a bone is liable to break under pressure, are void.

Spontaneous fractures.

These spontaneous fractures really do not belong to the chapter on fractures, but to that on diseases of the bones, and the breaking of such a bone is really only a symptom of the disease in question.

Traumatic fractures are either **compound or simple,** according to whether the skin and soft parts are injured at the same time with the

Traumatic fractures.

bone, so that a communication exists between the fractured bone and the outer air. This fact, while still important, has in modern times lost a great deal of its significance as regards danger. Even where the skin is not perforated by the piercing bone, but injured by the same violence, as, for instance, in cases of fractures by direct force, the result is the same in so far as a communication exists.

Varieties of fracture.

The breaking of the bone may be either **complete or incomplete** (fissure, infraction, green-stick fracture). In complete fractures the **line of fracture** either **runs transversely** (at right angles to the axis of the bone) or **obliquely,** or **lengthwise,** or **in spiral form.** If the bone is broken in several places and splintered, we speak of a **comminuted** fracture.

The fracture may be brought about by **direct or indirect force.** If a man who holds up his right arm to shield his head is hit by a blunt object, a stick, for instance, the **ulna breaks where it is hit.** The production of a fracture by indirect force is illustrated by the breaking of a wooden stick when bent beyond its elasticity, or compressed in the direction of its axis, as in a vise. If the rod is of homogeneous construction, it breaks at a certain definite point; if it is of varying thickness and architectural resistance, it **breaks at its weakest point.**

Age of injured person.

Of **great importance is the age** of the injured person. The statistical fact, that **most fractures occur between thirty and forty,** is easily explained, as this age is most exposed to violence. The elasticity of the bones of **small children** up to ten years saves them from many fractures. From ten to fifteen the **epiphyseal line** between the diaphysis and epiphysis becomes of importance, as then traumatic separation of the epiphysis may occur. With advanced years the bones become more and more fragile by **senile atrophy** of the bone tissue, which is responsible for many fractures.

Another form of fracture is important, where the patient **breaks a bone by muscular action** tearing it apart, as, for instance, fracture of the patella without any fall.

Varieties of deformity.

2. The **deformity** to be observed by inspection may assume one of the following forms:

Angular dislocation of the fragments (ad axin).

Lateral dislocation (dislocatio ad latus).

Lengthwise displacement (dislocatio ad longitudinem). Here the fragments are either held apart by opposing forces (**diastasis,** as, for instance, the fragments of a patella) or they glide alongside of each other,

thus producing a marked shortening, as a result of the action of the attached muscles.

Dislocation by rotation (dislocatio ad peripheriam), as, for instance, that of the peripheral fragment in a fracture of the neck of the femur.

These classical distinctions are not of very great value, as the different **forms of dislocation are usually combined.** Since our knowledge has been so much amplified by the study of skiagrams, we know that this methodical classification does not correspond with the real conditions disclosed by the Roentgen pictures.

Abnormal mobility.

3. **Abnormal mobility** is practically **present,** to a certain extent, **in all fractures,** except in cases of infraction (though it may be felt in some of these cases too) and in impacted fractures. If the bones are very short, or held tightly in place by muscular action, as, for instance, the ribs, the proof of abnormal mobility may be very difficult or impossible.

Crepitation.

4. **Crepitation** is brought about by the **grinding of the fragments,** if they are moved against each other. In some cases it can be heard, usually only felt. As the more or less torn periosteum is insulted in this procedure, this part of the examination is exceedingly **painful,** and it therefore ought to be carried out quickly and if necessary **under narcosis.** Extreme care has to be exercised not to mistake **crepitation of blood extravasation** for bony crepitation. Crepitation may be absent if the ends of the fragments cannot be brought into direct contact. This may be due either to diastasis or to overlapping of the ends, or to interposition of soft parts, as periosteum or muscle. The **examination** of the fracture ought to be **carried out with extreme care,** to avoid unnecessary pain as well as the possibility of further injury. Special attention ought to be paid to inspection, which surely does not hurt the patient. If we have reason to assume that the **reduction of the fracture** will be difficult, as in very muscular individuals, **narcosis is indicated,** which we will then use for diagnostic purposes as well as eventually for Roentgen examination. As soon as the contracted muscles are relaxed, the recognition of a fracture is very frequently easy. Besides this, reduction is much more easily effected.

Narcosis.

Measuring.

Measuring with a **tape-measure** is usually without any value whatsoever. A trained eye can generally detect not too slight differences in length better than an uncertain measuring from a rounded surface, like the spina ossis ilii. To measure diameters exactly, the **calipers** are of great value.

Fracture of the Clavicle.

Fracture of the clavicle is **second in frequency,** and occurs mostly in children and young persons. It may be said that, **where a child fractures the clavicle, the adult dislocates his shoulder.** The fracture may be either **incomplete or complete.** It takes place as an oblique fracture in the middle of the bone or more laterally. The fracture of the inner third is rare.

Cause. The cause is **indirect force,** usually a fall on the outstretched hand with fixed elbow and shoulder-joint. Frequently the clavicle breaks from a fall on the shoulder. **Green-stick fractures in babies** give such slight symptoms that they are frequently not recognized until the callus is formed, which then explains why the child cried when the arm was lifted.

Symptoms. In complete fracture the symptoms are very clear, the **shoulder is lowered** and the **head inclined toward the affected side.** The flattening of the shoulder affects more the region of the clavicle, while the rounding of the deltoid region is preserved. The **fragments usually override** one another, so that the shortening of the distance from the sternum to the end of the clavicle can usually be easily observed. The **arm is nearer to the sternum** than on the other side, and usually **rotated inward.** At the place of the fracture, there is a decided **tumor** produced by the angle between the two fragments. If the fingers follow the outlines of the clavicle, we feel the interruption of continuity and dislocation of the outer fragment very plainly; at the same time the patient gives signs of lively **pain.** If we look at the patient from **behind,** we notice that the **mesial edge of the scapula** of the affected side is farther from the line of the spinal processes than on the sound side. The patient is **unable to raise the arm.** The diagnosis offers really no difficulty, if the above symptoms are observed.

Differential diagnosis. If the fracture is very **near the acromial end,** it might be mistaken for a **supra-acromial dislocation,** but the distinct **pain at the place of fracture,** the **irregular surface** of the fracture, and **crepitation** will prevent a mistake, even if no skiagram is made. One of the fragments, especially if pointed, may **injure one of the large veins,** and thus form a large **hæmatoma.** This is especially the case with compound fractures.

Dislocations of the Clavicle.

Supra-acromial dislocation. The **typical dislocation of the acromial end is upward** (supra-acromial luxation of the clavicle). If the dislocation is complete, it can easily be

SUPRA-ACROMIAL DISLOCATION OF CLAVICLE.

recognized by its **characteristic deformity** and its distinctly palpable **protruding articular surface.** The lateral end of the dislocated clavicle protrudes sharply at a right angle, so that the resulting deformity appears terrace-like. The **clavicle is not shortened,** as in cases of fracture, and there is no **crepitation.**

Dislocation downward (subacromial luxation) is **very rare;** so also is **subcoracoid luxation,** which is still farther downward.

Presternal dislocation.

Dislocation of the sternal (mesial) end of the clavicle occurs most frequently in the form of presternal dislocation. The mechanism is by **exaggerated forcing of the shoulder** backward by a blow, fall, etc. Sometimes the dislocation has been effected by over-exertion in throwing a ball.

Diagnosis.

The diagnosis is easy and can hardly be missed: Typical **pain** at the point of injury, the **head inclined** toward the affected side, and dropped. The dislocated clavicle forms a distinct **tumor on the surface of the sternum,** and is easily recognized if the shoulder is moved. The **distance of the acromial end** of the clavicle from the mesial line is **shortened** sometimes. As a result of **compression of the plexus,** the patients sometimes complain of the arm going to sleep, and a tingling sensation along the extremity.

The **dislocation upward (suprasternal luxation)** is much rarer; still more so, the **dislocation backward,** behind the sternum **(retrosternal luxation).** In the former the **tumor** is to be found **in the jugulum,** where it may press on the trachea and thus produce **dyspnœa.** The latter is very **characteristic** in its symptoms. In place of the capitulum of the clavicle, we feel a **pit, which corresponds with the empty articular socket.** The **mesial half** of the clavicle **is sunk in,** the **lateral half protrudes** forward. The supra- and infraclavicular **fossæ are** decidedly **filled in.** The **shoulder is sunk** downward, inward, and forward. The **head** is usually (not always) **inclined toward the opposite** side.

Symptoms of retrosternal dislocation.

Complications.

In rare instances a displaced clavicle has produced by pressure on the vessels, nerves, and other organs, cyanosis, dyspnœa, singultus, dysphagia, absence of pulse under the radial artery of the affected side. If the **trachea is torn, emphysema** of the skin will form at once, and thus cover all local symptoms.

Dislocation of both ends of a clavicle is extremely **rare.**

Fractures of the Scapula.

They are **rare.** **Compound fractures** of the scapula **by bullets** may assume any form, either the ball tearing a hole through the blade, or an irregular splinter-fracture being the result. The splinters may then be driven into the lung.

Subcutaneous fractures affect the body, the neck, the acromion, or the coracoid process.

Fracture of the body most frequently runs transversely. The cause is usually a great direct force.

Diagnosis. The diagnosis is indicated by a **fixed local pain,** spontaneous as well as during breathing, coughing, sneezing. The spot is **tender on pressure.** The **fragments are dislodged** in such a way that the **lower part of the shoulder-blade** is moved laterally upward, and usually **shoved under the upper part.** Abnormal **mobility and crepitation** are present. To find these signs it is necessary to abduct the arm strongly and retrovert it. The Roentgen picture will show the fracture clearly.

Fracture of the Collum.

The cause is a **blow or fall on the outer end** of the shoulder. At the moment of the fracture the **whole arm sinks down,** the broken articular process being pulled down by the weight of the arm. At the same time,

Diagnosis. the upper part of the **humerus is adducted** toward the axillary line, and the **elbow is abducted;** the axis of the arm is therefore oblique, the acromion is prominent. The dislocated head with the fractured collum **bulges out the deltoid** muscle. At the place where the head of the humerus normally is, a **pit** can be felt.

If we look at the patient from behind, the **injured arm** (with flexed forearms) **appears elongated.** The **head** of the patient is **inclined toward the affected** side. The **arm is freely movable,** but motion causes severe **pain.**

Other disturbances and **paralysis of the axillary nerve** may occur. In certain positions the jagged surface of the fracture can be felt instead of the smooth glenoid surface.

Differentiation. The fracture may be mistaken for a **dislocation of the humerus forward,** or for a **fracture of the surgical neck** of the humerus, or for a **luxatio supracromialis** of the clavicle.

Fracture of the Acromion.

It is comparatively frequent, the acromion being rather exposed to traumatism. Patients complain of **local pain,** which is **increased on pressure or by active raising** of the arm. The **head is** frequently **inclined toward the affected** side. The **shoulder** appears somewhat **flattened.** If the arm is pulled down, the diastasis of the fragments is increased, so that the finger can be put into the crack. The fragment shows abnormal **mobility,** and sometimes crepitation.

Fracture of the Coracoid Process.

Fracture of the coracoid process occurs very rarely singly, more frequently **combined** with dislocation of the head of the humerus, or fracture of the clavicle, or acromion.

The symptoms are not very clear. The **pain is increased** if the supinated forearm is flexed to the utmost at the elbow-joint, as then the biceps pulls at the fragment.

Dislocations of the Shoulder.

These comprise more than fifty per cent of all dislocations, and are by far the **most frequent dislocation.** They occur mostly between the ages of fifty and seventy, and four times as frequently in men as in women.

The most common forms are:

Varieties of dislocation.

1. Luxation forward (subcoracoid or preglenoid dislocation).
2. Luxation downward (axillary dislocation).
3. Luxation backward (backward and upward, subacromial, and backward and downward, infraspinata).

The other forms are rare, and are described as subclavicular, erecta, and supracoracoid.

1. **Subcoracoid Dislocation.**—The diagnosis can frequently be made by inspection alone. The two sides have to be put in a position as symmetrical as possible, with the patient in a good light. Then we see from in front, the **outline of the shoulder** over the acromion and down the deltoid, **forming a right angle.** The normal rounding of the shoulder is lost, the **arm is abducted,** the elbow stands off from the thorax. The **axis of the arm** leads under the coracoid process or toward the clavicle, not to the acromion. The **outer contour** of the arm appears, a little

Diagnosis.

above its middle at the insertion of the deltoid, sharply bent, **forming an obtuse angle outward.** From behind, the **affected arm appears longer.** Under the acromion the **socket is empty.** Under the coracoid process we observe an **abnormal bulging,** corresponding to the **dislocated head.**

The **cause** is usually a fall on the outstretched arm, producing an abduction or hyperabduction. Sometimes the **arm is torn out of its socket** as, for instance, with sailors holding on to the sheet in jibing.

If the injury is not fresh, swelling may cover the deformity to some extent, so that an *x*-ray picture may become necessary.

2. **Axillary Dislocation.**—The mechanism is the same. The **symptoms** are the **same as in the subcoracoid** dislocation, only the abduction is still stronger. The head can be felt and sometimes seen in the axilla.

Diagnosis. 3. **Dislocations Backward.**—These are very rare. **Symptoms of the infraspinata.** If we look at the patient from the side (in profile), the **shoulder appears broadened,** the **arm is abducted,** slightly elevated and rotated inward. The **glenoid fossa is empty.** The head can usually be felt and seen as a **rounded bulging tumor** in the fossa infraspinata. Sawing motions of the arm show the connection of this tumor with the humerus.

The **subacromial dislocation** is more frequent. The symptoms are about the same, but the head is less far distant from the glenoid surface and can be felt at the edge of the socket.

Complications. Dislocations of the shoulder can be complicated by **fractures** of the anatomical or surgical neck of the humerus. Sometimes the fractured and dislocated head of the humerus turns completely around. The Roentgen picture will be the safest guide to a diagnosis, which is important, as these cases usually need **operative interference** (extirpation of the broken head).

Old dislocations. If the dislocations are old, *i.e.*, more than six to eight weeks, they show the same symptoms, except that the abduction from the trunk is a great deal less marked. In still later stages, a **false joint** may be formed and surprisingly free motion may be possible. Radiographic pictures will solve any doubt.

Habitual Dislocation of the Shoulder.

If after reduction of a dislocation of the shoulder, the anatomical conditions do not become normal again, **repeated dislocation** may follow.

The principal **cause** for this is **abnormal enlargement** and **relaxation**

of the capsule, or sometimes a **tear in the capsule** (inevitable in the case of any dislocation) does not heal. In other cases small **fragments of the glenoid edge** are broken off. The symptoms of habitual dislocation are the same, but the mechanism is different, as frequently only very light force is necessary to produce it.

INJURIES OF THE SOFT PARTS.

Contusions, Sprains, and Wounds of the Shoulder-Joint.

Contusions and sprains of the shoulder-joint are very frequent, and have been **underrated** in their seriousness until lately. Frequently a fall on the shoulder, where the absence of any injury to the bone can be proven by a skiagram, is followed by **serious disturbances** of motion or function of the joint. Such an injury, however slight apparently, has to be taken seriously, and the **prognosis** set down as doubtful. Immediate proper treatment prevents bad results.

Wounds of the shoulder, especially shot-wounds, can only be examined with the probe, etc., on the operating table.

Injuries of the Vessels.

Injuries of the vessels by cut, stab, or shot, are not rare, and frequently fatal in a short time. If the wound of the artery is small, the external hemorrhage may be insignificant.

Aneurisms.

For diagnosis we have to look for a **pulse distal** from the spot of injury, and for a peculiar **halituous bruit** over the injured artery, a sound to be compared with that made by breathing in one's hands in cold weather (Wahl's symptom).

If this symptom is distinct and the pulsation clear, the **diagnosis of traumatic aneurism** is established. If pulsation is absent and the inflammatory infiltration of the soft tissues markedly developed, the diagnosis may be more difficult. Such aneurisms may be mistaken for other tumors and abscesses. If after a dislocation or some other severe trauma, a rapidly growing **tumor of arterial nature** can be made out, immediate **ligation** is to be recommended.

Injuries of the large veins are much rarer than those of the arteries. The diagnosis rests on the **color of the escaped blood** and the absence of a pulsatory character in the manner of its flow.

Injuries of the Nerves.

Gunshot wounds of the brachial plexus are comparatively rare, as the nerve apparently yields because of its elasticity, and thus escapes.

Dislocations of the shoulder, fractures, undue formation of callus after fractures of the clavicle or of the collum scapulæ, frequently give rise to paresis or paralysis of the plexus. They are recognized by more or less extensive **sensory and motor** paralysis, frequently **combined** with severe pain, neuralgias, and sometimes clonic spasms.

Paralysis of the plexus.

The **muscles** of the affected nerve-region become **atrophic,** and show later on symptoms of **degeneration.** The **skin** of the hands and fingers appears glossy, the entire arm is cooler, and is the seat of hyperhidrosis.

If a dislocation of the shoulder has existed for any length of time, we find a **motor paralysis,** which affects the **ulnar and median** nerve only partly, while the **radial paralysis** is complete. The sensory functions are not impeded. A similar paralysis is sometimes observed **after operations** and is called narcosis-paralysis. This is due to **pressure of the head** of the humerus against the plexus, produced by long-continued elevation of the arm over the head of the patient, or hanging down of the arm. It has been found that this is possible only in persons with a very relaxed, loose joint-capsule, which permits a sort of subluxation of the humerus forward.

Narcosis paralysis.

The sometimes serious **paralysis of the deltoid,** following comparatively slight contusions of the shoulder, may be mentioned here. It is usually the result of a more or less heavy fall on the deltoid itself, with no fracture or dislocation as a result of the accident. Skiagraphy reveals nothing, sometimes a slight effusion into the joint can be found; nevertheless, the arm cannot be elevated, and **atrophy of the deltoid** muscle follows quickly. It is necessary to know this clinical picture, as only immediate energetic treatment (after twenty-four hours) consisting of massage and electricity, will prevent a serious and long-lasting chronic myositis, with shrinking of the capsule and the functional disorders caused thereby.

Paralysis of the deltoid.

CONGENITAL DEFORMITIES OF THE SHOULDER.

Congenital dislocation of the shoulder: subcoracoid, supra-acromial, and subacromial dislocations have been described as congenital malformations. It is more than probable that they are either paralytic, or the result of injuries *intra partum.*

Congenital Displacement of the Shoulder-Blade Upward.

This remarkable and **rare deformity** consists in a displacement of the shoulder-blade straight upward to an extent of one and a half inches. Frequently an **exostosis** in the upper mesial angle is **combined** with it. Often we find a slight **scoliosis,** the convexity of which looks toward the high-standing scapula. This scoliosis does not increase.

The exact **examination** of the shoulder-blades, especially if an exostosis is really present, is sometimes very difficult. An *x*-ray picture is serviceable. There is so little functional disorder caused by this deformity, that in some cases it has been discovered only by chance. The principal functional impairment is in the elevation of the arm.

Congenital deformities of the clavicle are **extremely rare;** they consist usually in **absence of the clavicle,** and the defect may be either total or partial.

The **diagnosis** is easy. The **heads of the humeri** can be brought together in front. A skiagram will of course show the defect plainly.

DISEASES OF THE SHOULDER.

Diseases of the Clavicle.

All the diseases of the bony structure of the clavicle are very rare. Frequency.
They are acute **ostitis** with periostitis, **osteomyelitis** due to infection by staphylococcus pyogenes aureus, as well as osteomyelitis after typhoid. Tuberculosis develops very rarely. Gumma as a tertiary symptom of syphilis does occur, but not frequently.

The **joints** of the clavicle are rarely affected by disease.

Neoplasms of the clavicle do not occur frequently. If they are as rare as the statistics of surgical literature would lead us to believe, my personal experience must have been exceptional, as I have operated on three cases.

Diseases of the Scapula.

Acute inflammatory diseases of the scapula are very **rare. Tuberculosis** is a little more frequent, and can be recognized by the general symptoms of tuberculosis, the course being a slow one with an inclination toward caseous degeneration and formation of abscesses, which may come to the surface by an indirect way.

Tumors. Tumors of the scapula occur in the **benign** form as well as in the **malignant.** The latter are more frequent. Either they belong to the class of **myxochondromas or cystic enchondromas,** and grow rapidly, or they appear in the form of the soft **sarcomas,** which have a tendency to involve the muscles. If they achieve any large size, they are apt to force the arm into abduction, and **cause positions similar to dislocation** of the shoulder. The lymphatic glands of the axilla need not necessarily be implicated.

Diagnosis. In the early stages the patients complain of little pain, and slight hindrance in motion, so that the growing tumor may be **mistaken for a rheumatic affection,** the more so as the patients frequently have fever, but the **irregular form** of the shoulder, as well as the undue **development of the veins,** calls our attention to a malignant tumor.

Early diagnosis is of the highest importance on account of the rapid growth and malignancy of these affections. If the diagnosis is in doubt, **harpooning** of the tumor to get small particles **for microscopical examination,** might be resorted to.

Diseases of the Bursæ.

The **bursa acromialis,** as well as the subdeltoid, becomes sometimes the seat of hygroma, the former by a subacute inflammation which is brought about by habitual **carrying of heavy loads** on the shoulders (hod-

Hygroma. carriers). In such cases we find on top of the acromion a **small, tensely elastic tumor,** over which the skin is not adherent. It can be **differentiated** from the lipoma by its hemispheric form and the absence of lobules. If the bursa becomes inflamed in a more acute stage, **extirpation** may become necessary. The **subdeltoid bursa** becomes the seat of acute inflammation not only after trauma, but also after empyema, pneumonia, and pyæmia. **Tuberculosis** is sometimes also responsible. To the latter category belong the **hygromata oryzoidea.** We find in the anterior part of the shoulder a hemispherical, tense, **fluctuating tumor** of very slow growth, which finally may reach half the size of an orange, or that of a child's head. A certain indistinct crepitation is to be felt, due to the presence of the so-called rice bodies.

Exploratory puncture usually does not give any definite result, as the rice bodies are too large to pass the cannula.

Inflammations of the Axilla.

Furuncles and inflammation of the **sudoriparous glands** of the axilla are quite frequent, and are easily recognized as such. The latter may exist in the form of deeply indurated, **hard nodules,** occasionally forming small abscesses.

Small, neglected injuries of the fingers, hands, or mammæ frequently lead to **suppuration and phlegmon of the axilla,** after the infectious material has been carried centrally by the lymphatic ducts. If the original injury has been overlooked, as so frequently is the case, the swelling of the axillary glands is sometimes **apparently the first symptom.** In some cases the red streak of the **lymphangitis** can still be seen, leading to the glands. They are extremely tender, and usually **high temperature** prevails. The arm is kept voluntarily in **slight abduction,** the **axilla is very tender** on pressure. If the phlegmon is situated deeply, its recognition may be a little more difficult, but the **high fever and local pain,** with the impossibility of abducting the arm any further, **lead to the diagnosis.** Frequently the veins are much enlarged, and show plainly as deep blue lines. As soon as the diagnosis is made, **incision** is indicated at once, even if no fluctuation can be found. Phlegmon.

The presence of a large mass of axillary glands may be **one of the symptoms** of Hodgkin's disease.

Aneurisms of the Axilla.

They are either the **result of endarteritic processes,** or the result of **injuries.** In the former we find a slowly growing, **pulsating tumor** of oval, round, or spindle form, causing **slight pain and paræsthesia** by pressure on the neighboring nerves. The **pulsation** is isochronous with the systole of the heart; over the aneurism is a distinct **blowing sound;** both this and the pulsation disappear on compression of the subclavicular artery. **Numbness** of the arm and **shooting pains are typical,** if the aneurism has reached any size. Symptoms.

In the later stages, the tumor, which was first soft and compressible, becomes harder. **Beware of exploratory puncture!**

Tumors of the axilla are so **rare** that it is sufficient to mention that lipoma, fibroma, and angioma occur, as well as malignant tumors, which are, however, usually secondary. Tumors.

Of some importance is the **mamma aberrans,** which may form a real

tumor, the true nature of which may not be recognized until after extirpation. Sometimes one is led to the diagnosis by the fact that these tumors **swell and become painful during menstruation,** or by **milk-fistulæ,** which perforate the skin and give exit to a typical discharge.

Inflammation of the Shoulder-Joint.

Inflammation of the shoulder-joint may be due to a number of etiological factors. The simple **serous effusion and inflammation** of the shoulder-joint occurs frequently after light traumas, as twists or sprains.

Effusion. The effusion in the joint is rarely large or pronounced enough to be felt distinctly with the examining fingers, but there is a **constant point of pain,** which is never lacking, **along the tendon** of the biceps. If the **deltoid region** of the joint appears protruding, a secondary affection of the deltoid synovial bursa is probable.

Rheumatic affections very frequently attack the shoulder-joint. As I consider rheumatism entirely a **surgical disease,** at least so far as its treatment is concerned, I mention it here. As soon as the diagnosis is made, evacuation of the joint by aspiration is to be recommended, besides medical treatment.

Besides the above-named **swelling of the capsule** and **tenderness** along the biceps tendon, the symptoms are principally **functional difficulty,** in active motion especially abduction, in passive motion especially outward rotation, and extreme painfulness.

Purulent form. This serous effusion into the joint may become purulent, especially if it appears as a **secondary symptom** after typhoid, scarlet fever, smallpox, pyæmia, etc. If pus is formed in the joint, **high fever,** frequently with chills, and **extreme painfulness** indicate this process. The skin becomes hot and red, finally the **capsule is perforated,** and the pus escapes and forms an **abscess** along the biceps or under the deltoid. If pus has not been evacuated artificially, the cartilage will be destroyed, thus producing a distinct crepitation.

Tuberculosis. Tuberculosis attacks the shoulder-joint comparatively **rarely.** Patients from the fourteenth to the thirtieth year are most disposed. Infection frequently takes place after a trauma. By far the most frequent form of tuberculosis of the shoulder-joint is the so-called **caries sicca,** which presents a very distinct and typical clinical picture, but nevertheless may be mistaken for rheumatic, or neurotic, or traumatic affections.

Symptoms of caries sicca.

First, a **general swelling** of the capsule is observed, which is extremely tender on pressure. At the same time there is a certain weakness with **disturbances of function,** especially early in the morning. Later on acute attacks of **pain not unlike neuralgia** appear. The joint soon becomes stiff, and **atrophy** of the entire shoulder region is observed. The swelling of the capsule by this time has disappeared, there is little or no fever, the shoulder becomes more and more flat. After a while the head of the humerus feels decidedly smaller to the examining fingers, and appears adducted toward the shoulder. In not full-grown individuals, the **growth of the humerus** is arrested. Patients with tuberculosis of the shoulder seem to be very apt to acquire tuberculosis of the lungs, a fact which the physician should bear in mind.

Arthritis due to tabes and syringomyelia.

The **neurotic forms** of arthritis are due either to tabes or to syringomyelia.

The **tabetic affections** of the joints attack more frequently the lower extremities, while **syringomyelia** has a special tendency toward the shoulder-joint.

In **tabes** the joint affection may occur in the **preatactic** stage and may thus form an **early symptom.** The course is exceedingly irregular, sometimes rapid, leading to considerable **destruction of the joint** without much subjective disturbance. Sometimes the head of the humerus becomes so atrophic as practically to disappear, thus permitting **spontaneous dislocation** as well as passive dislocation in all sorts of positions.

Syringomyelia leads frequently to large effusions, relaxation of the capsule with fatty degeneration of the synovial membrane, and decided changes in the head of the humerus. Usually **atrophy** leads to habitual luxation. All these symptoms develop **without any pain** whatsoever. Usually there is analgesia and disappearance of the temperature sense.

Arthritis deformans.

Arthritis deformans is not rare in the shoulder-joint. It attacks nearly exclusively **elderly people,** and is **characterized by the formation of osteophytes** and fimbriate growths of the capsule. Quite frequently this affection occurs **after injuries** of the shoulder-joint. The **symptoms** consist in the beginning solely in the **hindrance of** a number of specified **motions,** usually abduction and rotation. Pain is completely absent. Very soon a **distinct creaking** and cracking is to be heard during the execution of certain motions, which is so loud that it can be heard at some distance. The **muscles become atrophied** after a very short time, while the capsule becomes indurated. Effusion is present, and the **head of the**

humerus is increased in volume. If there is any doubt about the diagnosis, a skiagram will show the osteophytes plainly.

Gonorrhœal arthritis.

Finally gonorrhœa as well as syphilis may affect the shoulder-joint; the former has the character of a serous or purulent arthritis, is usually **monarticular** and is characterized by **exceedingly violent pain.** If the effusion is purulent, very **high fever,** 106° and more, and chills are typical. The urethral discharge may still be present, or have disappeared some time since. **Puncture of the joint** does not necessarily reveal the presence of gonococci. Whenever there is any large effusion present, but especially if there is a suspicion of purulency, possibly proved by exploratory puncture, the joint ought to be evacuated.

Syphilitic arthritis is **rare** and does not show any characteristics, and the diagnosis can rest only on other signs of syphilis. In contrast with the gonorrhœal affection of the shoulder, the luetic arthritis is **polyarticular.**

Functional Disorders of the Shoulder-Joint.

There are a number of functional disorders of the shoulder-joint, which may be considered separately, although they are not diseases *per se*, but represent a pathological condition as the result of some disease.

Paralytic shoulder-joint.

One of these conditions is the paralytic shoulder-joint, due to the paralysis of the shoulder muscles, which is usually the result of injuries *intra partum*. In some cases this condition may be acquired. The fulness of the shoulder is absent, the **acromion protrudes,** under which (between the acromion and the abnormally low head of the humerus) a distinct pit can be seen and felt. The **arm usually hangs limp,** rotated inward, the hand in pronation. Active motion is exceedingly limited, and **elevation** of the arm **impossible.** The arm can only be swung in a pendulum-like fashion; and to raise the arm at all, the patient must hurl it up, so to speak. Passive motion is possible in all directions to the extreme, so that the head assumes different positions of dislocation; left to itself the arm sinks down again.

Neurosis of shoulder-joint.

The so-called neurosis of the shoulder-joint is **extremely rare,** and one should be very careful to exclude all other possibilities before coming to this diagnosis. The **principal symptom** is hyperæsthesia and pain in the region of the plexus, with few or no objective symptoms. Functionally the arm seems slightly impaired by a certain weakness.

A great many affections of the shoulder-joint, from slight distortions to serious inflammations, may be responsible for **contraction** or even

ankylosis of the shoulder-joint. If the case is comparatively fresh, involuntary contractions of the shoulder muscles may be mistaken for stiffness of the shoulder, due to shrinking of the capsule. This doubt can be decided in narcosis. Real ankylosis, of course, prevents any active or passive motion in the joint, and can be easily proven by a skiagram.

INJURIES AND DISEASES OF THE ARM.

INJURIES TO THE SOFT PARTS OF THE ARM.

Contusions as well as open wounds of all kinds are very frequent. **Injuries of the skin,** as tearing off by machinery, and burns, are of importance, as they usually result in serious **contractions.** It is sometimes not very easy to decide upon the probable vitality of half severed flaps of skin. Usually not too much confidence should be placed in the recuperative power of torn-off skin.

Injuries to the muscles.

Injuries of the muscles by blunt force or with sharp instruments are quite frequent. Of the former the most important is the **rupture of the biceps,** which may either be the result of an active or over-active exertion, as throwing the hammer or putting the shot, or be caused by the passive stretching of a voluntarily contracted muscle, as, for instance, if a man catches himself with his hands in falling from a height. The rupture usually takes place with a **distinct cracking sound,** followed immediately by **acute pain and functional disturbance.** Usually a pit is formed, into which one can lay a finger. The figuration of the biceps is changed, and the patient **cannot flex the forearm** in supination. The rupture of the triceps is much rarer.

Injuries to the vessels.

Injuries of the vessels of the arm are self-evident if **hemorrhage** is present. In its absence the form and place of the wound, the eventual **absence of pulse** in the peripheral part of the artery, the cold extremity, etc., must lead to the diagnosis. If the **artery and vein** are injured at the same time, an arteriovenous aneurism may form.

The **brachial artery** is rarely severed completely by blunt force, as by being run over, etc., while a tear of the inner and mesial layer of the wall of the vessel, with preservation of the adventitia, is frequent; this results, of course, in the **formation of an aneurism.** It is important to recognize such a condition, as it may be **connected with other injuries,** as heavy contusions of the muscles, or fracture of the humerus, and the disturbances due to the overlooked aneurism may be construed as the

result of inadequate treatment. Some cases of **ischæmic paralysis** of the muscles, for which a too tight plaster-bandage has been held responsible, are doubtless due to such overlooked injuries of the vessels.

INJURIES TO THE NERVES OF THE ARM.

If a nerve of the arm is **partly or totally severed,** or otherwise severely injured, this is recognized by the **loss of the motor and sensory functions** of the nerve in question. We have to keep in mind, though, that the sensory fibres of different nerves may supply one region of skin, so that the **loss of sensation frequently does not correspond** to the extent of the injury. The **faradic and galvanic** excitability of the injured nerve is **very soon lost.** Degenerative changes ensue after a short while. Besides the wounds or tears of the nerves, comparatively slight insults to the nerve may be responsible for serious paralysis. The so-called narcosis-paralysis has been mentioned above. Another form of **operative paralysis** is produced by the application of Esmarch's elastic bandage for bloodless operation. Still another important form is produced by the **pressure of crutches,** especially those without any cross-bar for the hand to relieve some of the pressure against the nerve and the head of the humerus. Paralysis.

Besides the usual injuries by wounds, etc., we observe quite frequently **injury of the nerve by fracture** of the humerus, where the nerve is pierced by a fragment, or even torn. Later on in the course of healing of fractures, an undue development of **callus,** which sometimes **encloses the radial nerve** completely, is not rare. Besides this, we observe quite frequently the pressure-paralysis produced during sleep, if the trunk rests on the arm, or if the head is pressed against the humerus, especially during sleep in drunkenness, or sleeping with arm hanging over the back of a chair; paralysis is noted at once, as soon as the patient awakes. Sleep paralysis.

By far the most frequent paralysis is that of the radial nerve. The **position of the hand** for this condition is **characteristic,** and well known as **wrist-drop.** The hand hangs limp from the forearm (is flexed in pronation), the same position which is typical for the radial paralysis in lead-poisoning. Radial paralysis.

The **muscles** which are **innervated by the radial nerve** are triceps brachii, supinator longus and brevis, extensor carpi radialis longus et brevis, extensor digitorum communis, extensor carpi ulnaris, extensor pollicis longus et brevis, and extensor indicis. It controls the **sensibility**

of the dorsum of the hand and fingers, with the exception of the little finger.

Symptoms of radial paralysis.

The first functional symptom of a complete radial paralysis is the **inability to extend** the hand and fingers. They hang down in pronation, extension to the horizontal line or above is suspended. If the basal (proximal) phalanges are extended by passive motion, the patient can stretch the middle and end (distal) phalanges very well (this is done by the interossei muscles, which are controlled by the ulnar nerve). **Spreading the fingers** and adducting them again is also feasible, if the hand is laid on the table. The **thumb is adducted** and stands under the other fingers. It cannot be abducted or extended. The hand can neither be adducted nor abducted owing to the paralysis of the extensor carpi longus and brevis and of the extensor carpi ulnaris, which together execute this motion.

If the arm is hanging down, the forearm in a straight line with the arm, **supination is impossible.** If the arm is elevated, and the forearm flexed, the latter cannot be extended.

Besides the complete paralysis of the extensors, there is an apparent weakness of the flexors of the hand, but this is only because by paralysis of the extensors, the points of origin and insertion of the muscles are approached, thus relaxing the flexors and preventing them for mechanical reasons from exerting their full power. If the hand is elevated (put in dorsal flexion) the flexors work normally.

The patients are greatly **hindered** in the coarser and finer manipulations with the hand and fingers. Quite frequently the paralysis is not so complete as described above. The farther distal the point lies, where the nerve has been injured, the more muscles are free; therefore, in most of the so-called sleep paralyses, the triceps is not damaged.

Other disturbances.

The **disturbances of sensibility** are much less pronounced, therefore trophic disorders are rare. **Atrophy** of the muscles sets in only when the paralysis is of long duration. On the dorsum of the hand frequently a **swelling** of the sheath of the tendon is observed.

As to the **electrical excitability,** it has to be noted that **below the point of lesion,** the nerve with its branches and their muscles stays normal for the faradic as well as the galvanic current, but from **above that point,** it is impossible to get an electrical reaction in the paralyzed region.

As to the details of the **reaction of degeneration,** the handbooks of nervous diseases must be consulted.

An important diagnostic point in differentiating traumatic radial

paralysis from lead-poisoning is that the **latter affects both** hands. It might be mentioned that besides lead, **arsenic** can produce the same paralysis, but in those cases the sensory disturbances are much more pronounced. Differentiation from lead-poisoning.

Polyneuritis frequently attacks the radial nerve, but in that case other nerves always show more or less pronounced sensory disturbances.

The median nerve is quite frequently the subject of injuries and insults. The muscles **supplied by the median nerve** are the pronator teres and quadratus, the flexors of the forearm with the exception of the flexor carpi ulnaris and the ulnar part of the flexor digitorum profundus, and the muscles of the ball of the thumb, with the exception of the inner head of the flexor pollicis brevis; the nerve controls the **sensibility of the radial half** of the hand. Therefore paralysis of the median nerve has the following effect: the **hand and fingers cannot be flexed,** the **thumb cannot be opposed,** and the larger part of the volar side of the forearm and hand is without feeling. It is interesting to know that after **suture of the median nerve,** the formation of a **keloid** can occur, as I have elsewhere described. Paralysis of median nerve.

The ulnar nerve is usually injured at the lower part of the arm near the elbow. The muscles **innervated by the ulnar nerve** are the flexor carpi ulnaris and partly the flexor digitorum profundus, adductor pollicis brevis, the muscles of the antithenar, the mesial lumbricales, palmaris brevis and interossei. Paralysis of ulnar nerve.

The nerve controls the **sensibility of the ulnar part** of the vola and palma, therefore the paralysis produces **inability to stretch** the distal phalanges and to spread the fingers, inability to move the little finger, and flex the basal (central) phalanges. If the paralysis exists for any length of time, the **atrophy** of the muscles produces the well-known **claw-hand,** *main en griffe.*

FRACTURES OF THE HUMERUS.

The humerus is most frequently fractured in the **diaphysis,** after which come in point of frequency the lower epiphysis, and, lastly, the upper.

Children are most often affected, and the frequency decreases with each decennium.

Before describing the different forms of fractures, I may say again in regard to the manner of examination, that much can be done by Examination.

mere inspection. The manner of palpating to feel the abnormal mobility and eventual crepitation differs according to the region where the humerus is broken. If apparently **the upper end** is affected, we hold with the left hand the shoulder of the sitting patient. We take with the right hand the forearm, and bring it into rectangular flexion, ask the patient to relax, if possible, and then rotate inward and outward. If the fracture is **in the middle,** we grasp with one hand the upper, and with the other the lower part of the arm. If the **lower epiphysis** is broken, one hand fixes the humerus, while the other hand flexes the forearm, or to find out the condition of the **condyles,** we take hold of the respective condyle, trying to move it, while the other hand fixes the shaft.

All these examinations can be made without undue force, only in very muscular patients with strong contractions of the muscles it may become so difficult to make out the fracture, that narcosis is desirable. All these diagnostic difficulties are easily overcome by simple *x*-ray photography.

Fractures of the Upper End of the Humerus.

They usually occur in advanced age, but have been observed in young persons through the epiphyseal line. According to the anatomical region where they occur, they are either **supratubercular,** a type which is represented by the fracture of the **anatomical neck,** or they are **infratubercular.** To the latter belong the **pertubercular** fracture, including the fracture along the epiphyseal line, and the **subtubercular,** formerly called fracture of the **surgical neck.** If any of these types are combined, **Y** fractures are the result.

Varieties.

Symptoms of supratubercular fracture.

The supratubercular fracture is extremely **rare.** Its symptoms are:

1st. **Pain,** very intense, increased by attempts of passive motion.

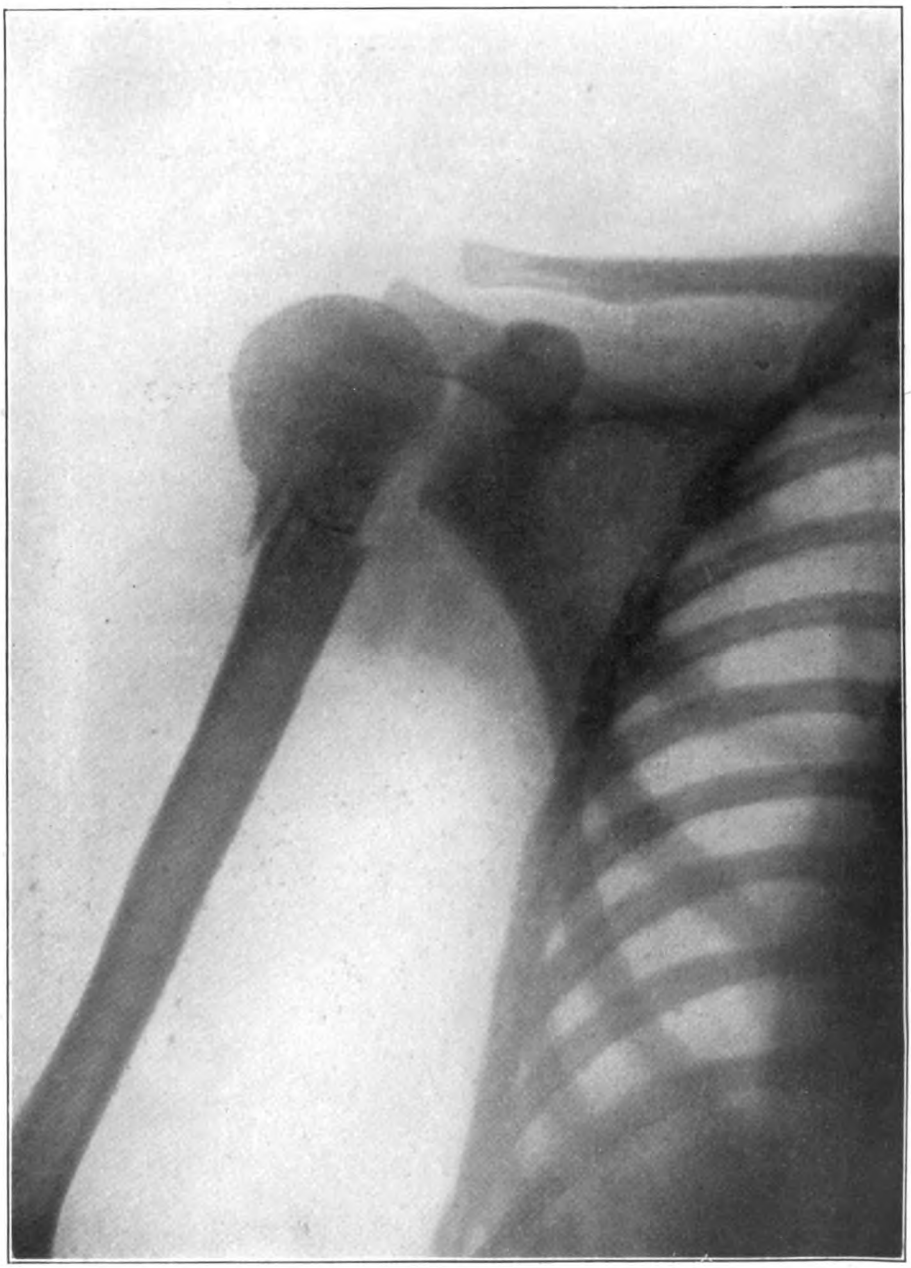
2d. Immediate complete **loss of function.** In simple contusion the pain subsides quickly, in dislocation the patient can make some motions after a short while. In fracture, even after days, the functional disorder is still complete.

3d. The **suggillation** and suffusion appear in fracture only after one to two days. In contusion they appear usually very quickly.

4th. **Examination** reveals great tenderness on pressure of the head of the bone, which is elicited by pushing the adducted arm in a vertical direction upward. The **pain** is very intense even though we do not touch the seat of the fracture. The same obtains if we take hold of the humerus at a point distant from the fracture, and try to move the lower fragment. Pressure on the head from without is very painful.

PERTUBERCULAR FRACTURE OF HUMERUS.

Note line of fracture through the head, and shadow overlying the mesial outline of humerus.



SUBTUBERCULAR FRACTURE OF HUMERUS (Anatomical Neck).
Fall on Shoulder.

5th. In some cases **dislocation** of the **fragments** can be felt.

6th. By elevating the arm and rotating the same, **crepitation** can be felt, except in case of impaction.

7th. The **shoulder** is **flat** and the arm **shortened,** as can be seen if both elbows are flexed and the patient is viewed from behind.

8th. By far the surest method is a **skiagram.**

Differential diagnosis.

In the differential diagnosis from dislocation, we must remember that there is no **dislodgement** of the head to be felt in fracture, as there is in dislocation. Besides, in fracture the arm is adducted or can be adducted easily, in dislocation it stands in abduction and cannot be adducted. **Rotation** is easy in fracture, impossible in dislocation.

Infratubercular Fractures.

The **infratubercular** fracture is best represented by the fracture in the **epiphyseal line.** It occurs up to the twentieth year, as well as during birth.

Symptoms.

The symptoms are sometimes not very pronounced, and only the pain is marked, especially if the arm is lifted incautiously. The upper fragment is drawn outward, the lower fragment drawn inward, and rotated inward. The arm is slightly abducted, and shows an angular bend at the insertion of the deltoid. The injury might be mistaken for a dislocation forward, but the **shoulder is not flattened,** and frequently there is a **sharp prominence** of the broken edge of the lower fragment, which is dislodged forward and inward. Crepitation is present, but is not so grating as usual. In small children the injury may easily be overlooked, as the symptoms are not at all pronounced.

In these cases also the Roentgen picture is of the highest value.

Subtubercular fracture.

By far the most frequent fracture of the upper end of the humerus is the **subtubercular** fracture (fracture of the **surgical neck**).

The lower fragment shows a mesial deviation, the **elbow is abducted,** therefore the axis of the humerus shows an angular bend. This position might easily be mistaken for dislocation of the shoulder, but in dislocation the deltoid outline is straight and perpendicular, in fracture the arching of the deltoid is preserved. **Adduction** of the elbow to the trunk is easy (at least usually), in dislocation it is difficult or impossible. **Rotation** in fracture is easy, in dislocation only outward rotation is possible. The head can easily be felt in its place. The fragments can best be felt from the axilla. The upper end of the lower fragment frequently assumes the

exact position of the head in dislocation of the shoulder and, if swelling has set in, might be mistaken for the same, if it were not for the presence of the head in its normal place.

The **Roentgen picture** easily solves all doubts.

Fracture of the Tuberculum Majus.

It occurs either **isolated** or **combined** with a dislocation of the shoulder.

Symptoms. The principal symptom is the **position of the head,** which is in forward subluxation. The head can be passively moved forward more than normal, and be rotated more inward. This is due to the tearing off of the muscles rotating the humerus outward. The fragment usually heals in wrong position, in diastasis, thus finally impairing the functions of the shoulder-joint to a marked degree.

If the fracture of the tuberculum is combined with a dislocation, the latter may be easily overlooked, as crepitation is felt at once, and one has no reason to expect a dislocation as well. If the symptoms of both injuries are considered properly, the latter can be recognized as such.

The **Roentgen pictures** are very important.

Fractures of the Shaft of the Humerus.

They are due either to **direct force,** as a blow, being run over, etc., or to **indirect force,** like a fall on the elbow or outstretched hand. The fracture may be either complete or incomplete; the latter occurs only in rhachitic children. The direction of the fracture-line varies greatly. The bone may break either crosswise, or lengthwise, or obliquely, the latter especially in spiral form.

For injuries of the **brachial artery** and the **radial nerve,** cf. pp. 328 and 329.

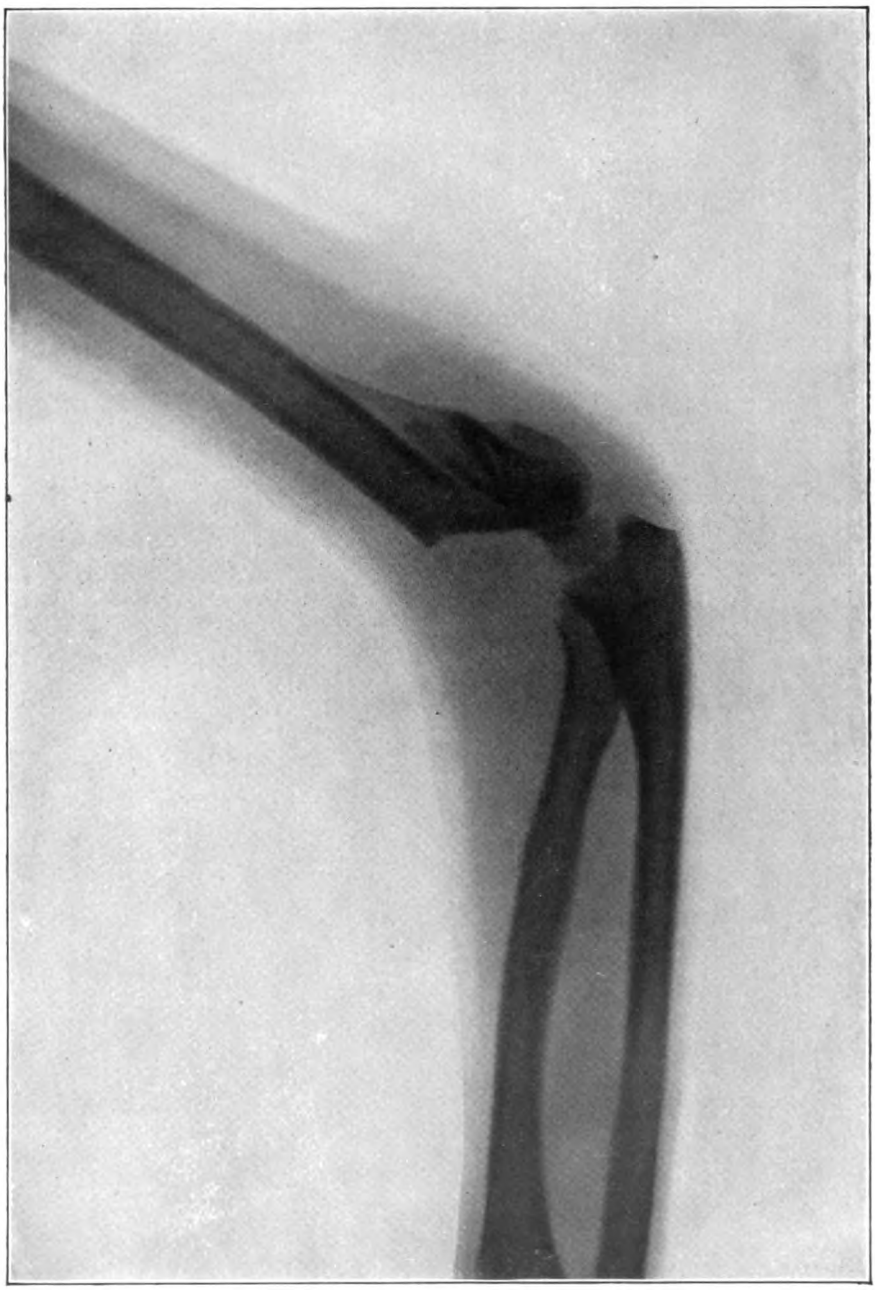
Symptoms. The **symptoms** are those typical of any fracture, local pain, suggillation of blood, abnormal mobility, loss of function. If there is any dislocation of the fragment, the deformity is characteristic. Crepitation can usually be easily felt.

The **Roentgen picture** cannot fail to reveal the fracture.

Fractures of the Lower End of the Humerus.

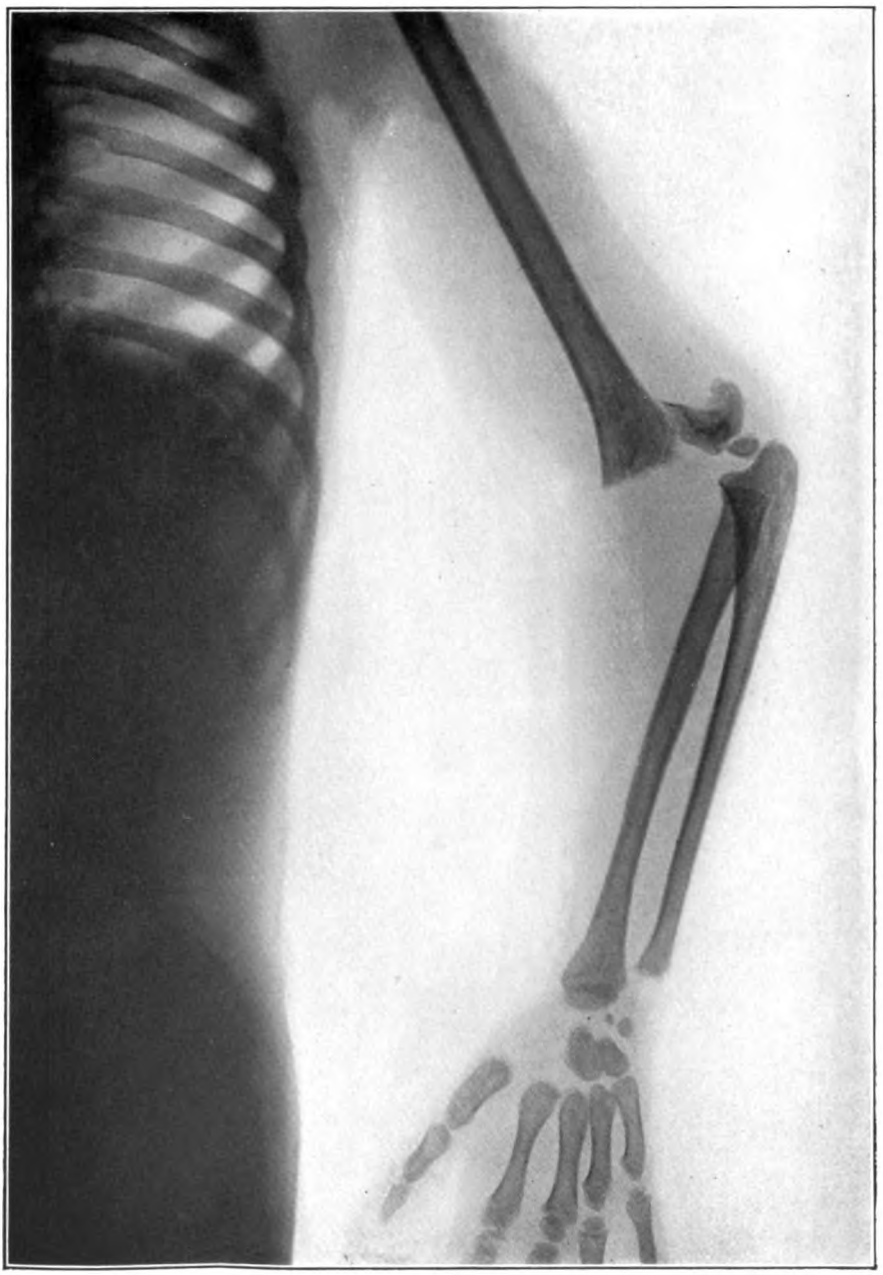
The fractures of the lower end of the humerus are rather complex, a great many different types being possible. While it is a question if they

FRACTURE OF DIAPHYSIS OF HUMERUS.
Produced by direct force.



SUPRACONDYLIC FRACTURE OF HUMERUS (Side View).

SUPRACONDYLIC FRACTURE OF HUMERUS.
Front view of case of Plate XX.



SUPRACONDYLIC FRACTURE OF HUMERUS

in a boy of seven, simulating dislocation of the forearm backward. Fall upon elbow.

are clinically so very different, it is necessary to know at least the different possible types. They are:

Varieties.

1st. **Supracondylar fracture,** where the lower part of the diaphysis is broken through completely just above the epicondyles. This fracture is very frequent, so is the next,

2d. The fracture of the **external condyle.** Besides the external condyle proper, the epicondyle and a part of the trochlea are broken off. Less frequent is,

3d. The fracture of the **internal epicondyle.** All the other possible fractures are very rare and of much less importance, they are:

4th. The **diacondylar fracture.** A complete transverse fracture occurs in a line between the cartilage-covered parts of the condyles and the epicondyles. This is the only fracture which may be completely intracapsular.

5th. Fracture of the **internal condyle.**

6th. Isolated fracture of the **epicondyle,** and

7th. **Partial** breaking off of the **external condyle.**

Besides these, **combinations** occur, which result in **T** or **Y fractures,** both of which are not rare.

The examination of these fractures and their fragments is not easy, and the use of the **x-ray pictures** is of great help.

Supracondylar fracture.

1. The **supracondylar** fracture may be a **flexion-fracture** or an extension-fracture, the latter being far more frequent. In this case the line of fraction runs from below anteriorly upward and backward, in the flexion-fracture the reverse. By the action of the triceps, the lower fragment in the extension-fracture slips backward, and presents the typical picture of dislocation of the forearm backward, for which this fracture is very frequently mistaken. The mistake may prove very serious, if forced attempts at reduction are made. These mistakes can be avoided only if we are perfectly familiar with the anatomy of the joint, get the exact bearings of the different prominent points, and then try to find crepitation. All these mistakes are much less frequent now, and will become impossible with the extensive use of skiagrams.

The principal symptoms are: the **arm is flexed** at the elbow-joint, the hand is in pronation, the forearm in apparent dislocation backward, the olecranon is higher than usual, but has not changed its relative situation toward the two epicondyles. **Abnormal mobility** is easily detected, crepitation only after the ends are brought into juxtaposition. There is a distinct measurable shortening of the humerus. All the typical fract-

ure symptoms are present, as pain, swelling, suggillation, and disturbance of function.

Fracture of the external condyle.

2. **Fracture of the external condyle.** The fracture of the **external condyle** is **second in frequency.** As the supracondylar fracture corresponds with the luxatio cubiti posterior, the fracture of the external condyle corresponds with the luxatio cubiti posterior externa.

In **children** the **fracture** occurs, in **adults** the **dislocation.** The **mechanism** is the same in both: most frequently a fall on the flexed elbow while the arm is abducted, so that the force hits the mesial plane of the olecranon, and is conducted on in the direction of the lateral part of the trochlea and the external condyle.

The symptoms of this fracture are much less pronounced than those of the fracture above the condyle, which is explained by the fact that only a part of the articulation is broken, no striking displacements therefore can be expected. As the **articulation of the ulna** with the trochlea is **uninterrupted,** passive flexion is possible, and frequently even active flexion. **Rotation** is very little interfered with, as this motion takes place in the joint between the ulna and the radius. The swelling is usually little, and the pain not very pronounced.

The principal symptom is the **deformity.** The axes of a normal arm and forearm form an obtuse angle open laterally. If a fracture of the external condyle takes place, this angle disappears and the two axes form one straight line, or they even form an obtuse angle open mesially. In examination we find that the forearm, if extended, can be moved in the sense of adduction; this produces pain. Besides this, a slight hyperextension is possible. The pain typical for fracture can also be elicited, if the forearm in complete extension is shoved upward toward the shoulder in the direction of the axis of the arm. Finally the broken-off external condyle is loose and can be moved.

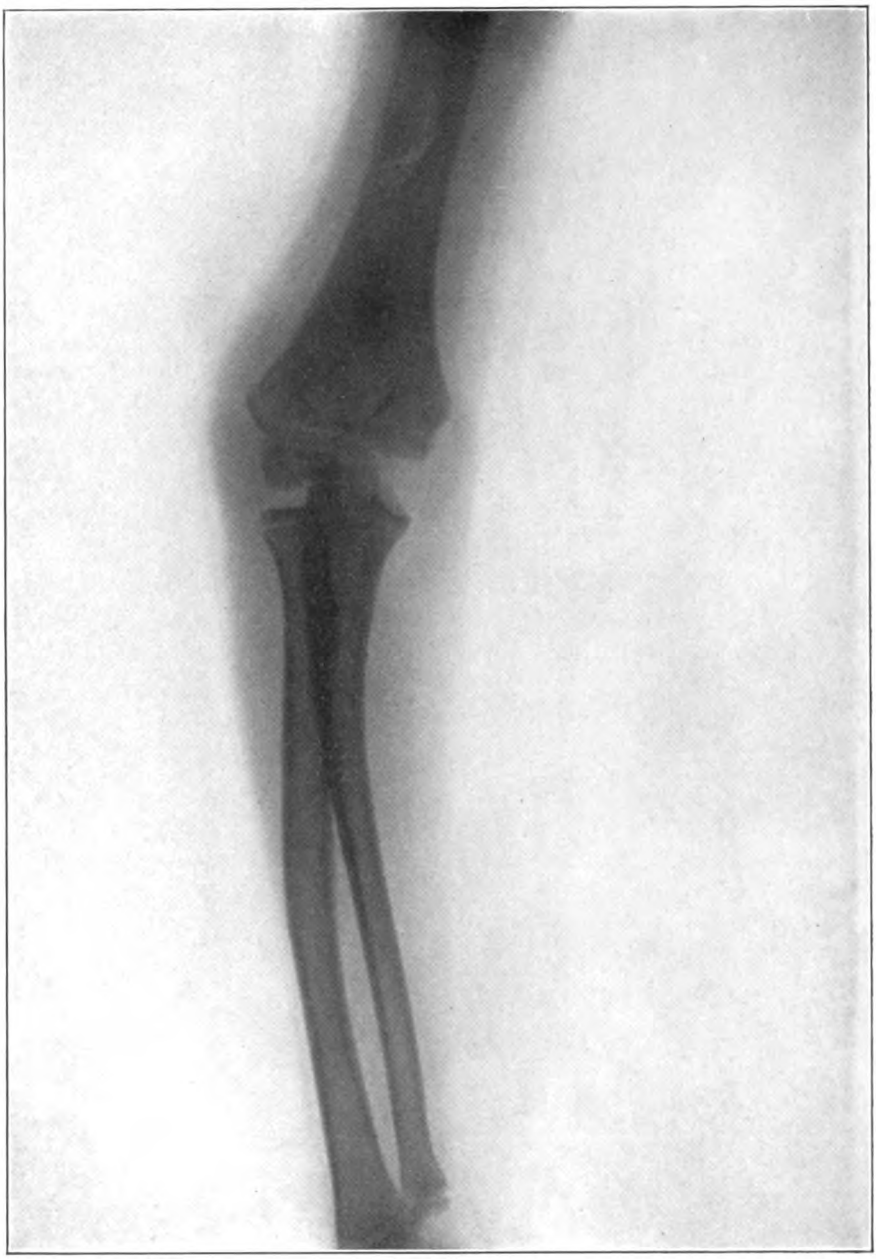
The **skiagram** shows the anatomical condition plainly.

Fracture of the internal epicondyle.

3. **Fracture of the internal epicondyle.** Fracture of the internal epicondyle is usually produced by a fall on the olecranon while the arm is abducted.

Its symptoms are so characteristic that, if they are known to the examiner as pathognomonic for a fracture of the internal epicondyle, nothing but the right diagnosis can be made.

Local examination reveals plain crepitation and abnormal mobility of the broken-off epicondyle. There is a distinct swelling in the region of the internal condyle, or over the entire joint.



EPIPHYSIOLYSIS OF HUMERUS.
Line of fracture immediately above articular surface.

Examination of active motions. The patients can usually extend to 145° and flex to 90° or 80°. Pronation is free, supination slightly hindered. If the patient is examined in narcosis, not only complete extension is possible, but hyperextension. This proves that the **frontal part of the capsule is torn** (anterior when the hand is supinated). It is necessary to know this anatomical point, because one may very easily, during examination, dislocate the forearm backward. This injury has been prepared for by the fracture of the internal epicondyle, which is always combined with a tear in the anterior portion of the capsule, producing the swelling over the entire joint named above. Frequently the dislocation is not only prepared for, but completed. The broken-off fragment slips downward into the articular line, sometimes slipping forward, where it may get caught in the joint. Anatomical conditions.

The symptoms, slight swelling, comparatively little pain (which is more severe at the time of the accident), nearly normal action, except hindrance in the extension, are sometimes so slight that the injury might easily be overlooked.

The application of *x*-rays will plainly show the character of the injury. Its recognition is of the highest importance, as in most cases **operative treatment** has to be recommended, either, in very youthful patients, suturing the epicondyle in its place, or, if this is not feasible, excision of the fragment. This latter course is especially to be recommended if we do not see the injury until some time after the accident, when the dislodged fragment has become fixed in the wrong place.

The other types of fracture are, first, quite rare in comparison with the fractures described, and, secondly, clinically not defined enough to put down exact rules for their diagnosis. Other types of fracture.

Only the **fracture of the internal condyle** is characterized by the fact that abnormal abduction is possible in passive movements, although the arm, when hanging down, does not show this deformity. The anamnesis is important for this type of fracture. It is produced only by a fall on the point of the flexed elbow.

If a greater force, for instance, a fall from some height, produces a fracture of the elbow, it usually results in a **T** or **Y** fracture, quite frequently compound. The fracture may be recognized if the forearm appears dislocated either forward or backward together with the articular end of the humerus, and if we can feel that the part broken off from the humerus does not consist of one piece, but of several fragments. The **x-ray picture** shows the condition plainly without any trouble. The recogni- T or Y fractures.

tion of the fracture is important for the reason that the result of the treatment will be good only if the fracture, in consideration of the complicated conditions, has been treated for a while by extension. The **Y fractures** very frequently show other cracks, reaching high up in the shaft of the humerus.

Pseudarthrosis.

Pseudarthrosis of the humerus (formation of a false joint) may be mentioned as the result of fractures, where an **interposition of the soft tissues** has taken place, thus preventing a bony union. Sometimes a real false joint is formed, with a capsule and very smooth surfaces of the articulating fragments. The pseudarthrosis is at once recognized by the **abnormal mobility** at the place of the old fracture, the **flexion of the arm** at the abnormal point in the attempt to raise the arm, and the absence of any pain. If the pseudarthrosis is not of very long standing, some swelling may yet be found.

Other deformities after fractures of the humerus result from union in a wrong position, especially in **angular deformity.**

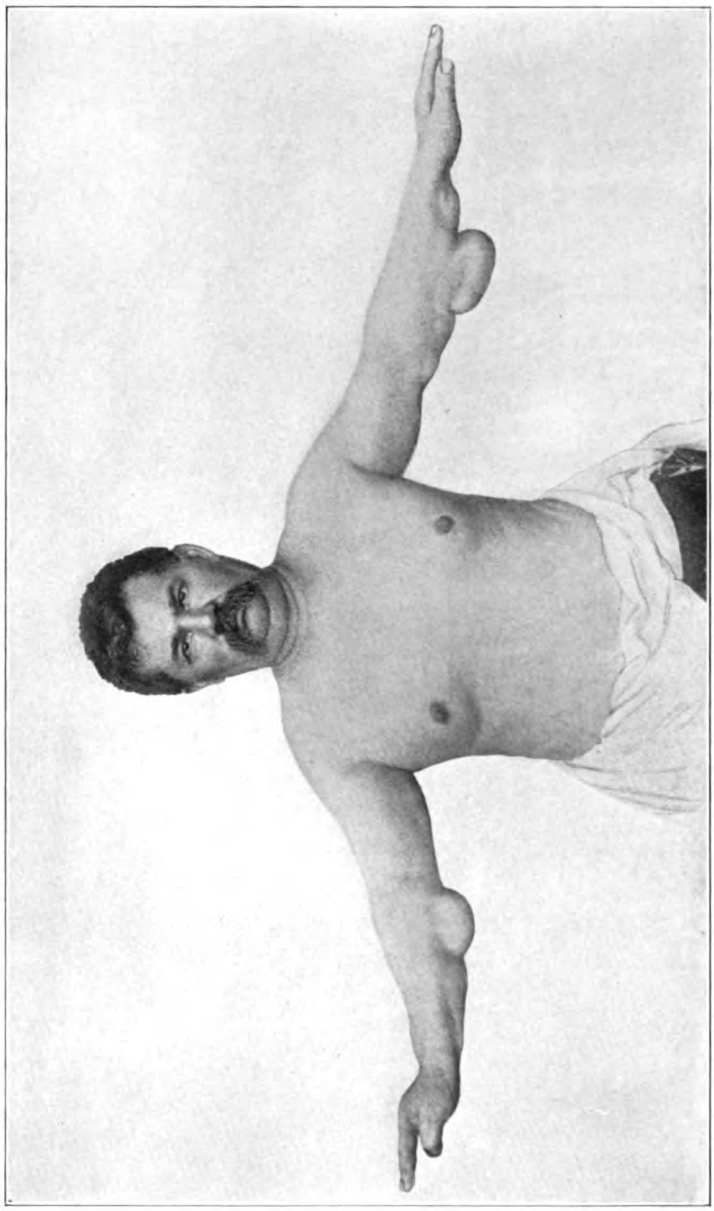
The diagnosis of fractures of the elbow healed in deformity may be extremely difficult, and even Roentgen pictures may not reveal the original character of the fracture.

Other Injuries of the Arm.

Injuries by machinery.

Persons who are tending certain **machinery** in factories, especially rotating parts in the form of circular saws, mangles, or combing-machines, or who are oiling belt-wheels, frequently suffer characteristic injuries. Either the fingers are first grasped and then fed into the machine, drawing in the entire arm, or in extreme cases the entire extremity is torn out. From a diagnostic standpoint these injuries are interesting and important, as it is impossible at first to decide how much of the injured limb can be saved, a question which must be left to be decided later on, meanwhile carrying through a treatment as conservative as possible.

When the arm is torn out completely, with or without the scapula, it is remarkable how comparatively slight the hemorrhage is, a fact which explains the unexpected good results in these mutilating injuries.



MULTIPLE FIBROLIPOMAS OF ARMS.
Following the course of nerves.

DISEASES OF THE ARM.

Diseases of the Skin.

The diseases of the skin of the arm are mostly those of **inflammation,** as erysipelas, lymphangitis, phlegmons, and like infections, which are usually conducted by the lymphatic ducts from the fingers, hand, or forearm, while only a few infections start from injuries of the arm itself.

The **red streak** running up on the mesial side of the arm indicates **lymphangitis,** carrying infective material to the next package of glands in the axilla.

Erysipelas presents the same aspect as on any other part; its early recognition is perhaps especially valuable, because the small circumference of the arm may make an arrest of the infection possible, by interruption of the continuity of the skin.

Phlegmons are recognized by their typical symptoms, local heat, redness, tenderness, infiltration, fluctuation. Phlegmons.

Of more importance are the **deep phlegmons,** which soon show immense swelling with discoloration and cracking of the skin, and blisters. These septic infections, usually leading to severe general symptoms, are due to the bacillus of malignant œdema, or to a mixed infection of the former and the staphylococcus. The course is exceedingly rapid (*gangrène foudroyante*).

Enlargement of the **cubital gland** has been recognized as a symptom of lues. Nevertheless it must not be taken for an infallible diagnostic symptom of that disease, except when there is no inflammation on the distal side of this gland.

One typical disease ought to be mentioned, viz., **inflammation of the bursa olecrani,** which is very frequent, in a chronic form, with gout. Acute bursitis by infection is quite frequent too.

Of the **tumors of the skin** I may mention multiple fibrolipomata, which are usually symmetrical, and frequently follow the course of the nerves of the skin. The accompanying illustration is after the photograph of a case under my personal observation.

Diseases of the Muscles of the Arm.

Acute or cold **abscesses** of the muscles, especially the biceps, frequently come under observation.

The **tuberculous forms** have a tendency to produce **wheals,** which

may be mistaken for a solid tumor. Since the recognition of **syphilitic myositis,** such cases affecting the muscles of the upper arm have been reported.

Myositis ossificans usually occurs after repeated (professional) insults or traumas, and produces the formation of a bone in the muscles. The internal brachial muscle seems to be especially predisposed.

Neoplasms are rare. Cavernous angiomas and sarcomas have been observed. They differ in no essential particular from other tumors of the kind; their true character very frequently cannot be recognized until after microscopical examination.

Diseases of the Vessels of the Arm.

They are mostly **aneurism,** sometimes in a cirsoid form, or in the form of arteriovenous aneurism after injuries. The small circumference of the arm makes their recognition easy, the aneurism showing the characteristic symptoms, as pulsation, thrill, etc.

Diseases of the Nerves of the Arm.

Neuritis is either one of the symptoms of multiple neuritis on an alcoholic basis, or is the result of an injury, in which case it frequently leads indirectly to atrophy and stiffness of the joint.

Tumors of the nerves are either neuromas, usually after severing of the nerve, or fibromas of the sheath of the nerve, or neurosarcomas. As the nerves of the arm can easily be felt, and decided tenderness on pressure exists, besides spontaneous pain, the diagnosis is not difficult. Another symptom is paræsthesia, while motor disturbances are rarer.

Malignant neuroma.

The so-called **malignant neuroma** usually attacks the median nerve, and belongs to the neurosarcomas. It is **characteristic** that instead of one tumor, there are a **number of lumps** to be felt along the course of the nerve. Usually the tumor has attained quite a large size before any nervous symptoms appear. The tumor is movable, so long as the surrounding parts have not become implicated. In later stages the tissues of the surface become involved and even ulceration takes place.

Diseases of the Humerus.

All three typical forms of inflammation of the bone occur in the humerus, viz., osteomyelitis, tuberculosis, and syphilis.

Osteomyelitis is not so frequent in the humerus as in the femur or

OSTEOMYELITIS OF HUMERUS.

Sequestrum begins right above epiphyseal line, reaching to the top of the picture.

tibia, and is usually not quite so violent. Nevertheless, it shows the **typical** symptoms of an acute attack beginning with chill and high temperature, **extreme painfulness** of the bone, even before the slightest swelling is perceptible, **especially at night.** Children affected with this disease frequently cry out loud in the night during sleep. Later on local tenderness appears with swelling. If the disease attacks the bone near the epiphysis, it may be mistaken for a rheumatic affection. As soon as the presence of pus can be surmised, **exploratory puncture** is in order, which will show the presence of staphylococcus pyogenes aureus. Early recognition of this disease is very desirable, not only to relieve the patients of acute suffering, but also to prevent further infection of the bone by early operation. Osteomyelitis.

If the upper epiphyseal part of the humerus has been affected, there will be serious disturbances of growth later on. The question **when to operate,** which has been extensively discussed, frequently has to be answered simply in the sense that operation is to be recommended as soon as the diagnosis is made.

Tuberculosis attacks the diaphysis of the bone much more rarely than the epiphysis. Tuberculosis of the upper epiphysis has been described as tuberculous affection of the shoulder-joint, while that of the lower will be found under diseases of the elbow-joint. The **diaphysis** itself is comparatively rarely attacked by this disease, except at its lower end near the epiphyseal line. It is a disease of slow development with gradually increasing swelling and little pain, no redness of the skin, except in the later stages, and the usual tendency to **caseous degeneration,** which finally leads to the formation of characteristic **fistulæ.** On opening, a wedge-shaped **sequestrum** is found. Tuberculosis.

The **general symptoms** are those of any other tuberculosis, irregular fever curve, usually not reacning above 102°, and the general light *malaise* ordinarily accompanying tuberculous affections.

Syphilitic affections of the humerus are rare, and often appear at the epiphyseal line. They occur in hereditary syphilis, as well as in the form of late tertiary symptoms.

Tumors of the Humerus.

They belong to the benign as well as the malignant form of tumors. We observe exostoses, chondromas, bone cysts, sarcomas, and carcinomas.

Exostosis is the result of an injury producing periostitis. In children Exostosis.

apparently spontaneous exostoses occur. The upper part of the humerus is mostly affected, where we find either one or several prominences of hard bony consistency covered by the muscles. There is little or no pain connected with the growth, no tenderness on pressure. If the exostosis attains a certain size, it usually interferes greatly with the action of the arm, which furnishes an indication for removal of the growth.

In the **differential diagnosis** it is important not to mistake these absolutely benign excrescences for **malignant tumors,** especially sarcomas and carcinomas. The overlying muscles may alter the original form of the exostosis to such an extent as to give the impression of a spindle form to the eye as well as to the touch. Except in absolutely clear cases, one should therefore always first make a diagnostic incision into the tumor during operation, before deciding upon exarticulation.

Cysts of the humerus are usually the result of an injury, and are characterized by their exceedingly slow growth, although the true character cannot be recognized except during operation.

Echinococcus occurs in the humerus more frequently than in other bones. If an exploratory operation is not permitted, the diagnosis, of course, will be impossible until the cyst has perforated, when the typical echinococcus-cysts or scolices may be found.

Sarcoma. By far the most common tumors are the **sarcomas,** which occur at the upper end of the diaphysis and the lower end in descending frequency. They occur between the ages of twenty-five and thirty-five, and show different grades of malignancy. Those belonging to the class of **myeloids** have a comparatively good prognosis. One of their **characteristic symptoms** is that the cortical lamella becomes as thin as paper, giving, on pressure, **a peculiar sound,** something like snapping a card (parchment crepitation). Trauma seems to be responsible for the starting of these tumors in a large number of cases.

The **symptoms** are dull pain, with comparatively little functional hindrance. The tumor first appears typically spindle-like, usually soon engages the shoulder-joint, and grows more or less rapidly to the size of a fist or even a man's head.

The diagnosis may not be very easy, especially in the beginning, when periostitis, osteomyelitis, and tuberculosis may come into consideration; this all the more so as a number of sarcomas during their growth are accompanied by high temperatures. On the surface of the tumor frequently large blue veins are plainly visible. Those tumors near the

EXOSTOSIS OF HUMERUS.
Skiagram excludes doubt as regards sarcoma.

SARCOMA OF THE HEAD OF THE HUMERUS.
In a young girl of nineteen.

shoulder-joint may present special difficulties in diagnosis, which the skiagram can best solve.

Carcinomas of the humerus are rare, but must be taken into consideration. They usually produce similar symptoms to those of sarcoma, and the differential diagnosis can be made only by microscopical examination.

INJURIES AND DISEASES OF THE ELBOW.

CONGENITAL MALFORMATIONS OF THE ELBOW-JOINT.

The few possible malformations of the elbow-joint are either very **rare,** or of so little practical interest that they cannot be considered here.

Congenital dislocation of the radius.

Of a little more importance is **congenital dislocation of the radius** at the elbow-joint. It is frequently combined with a more or less pronounced defect of the ulna. It can usually be easily diagnosed; any doubt is solved by a **Roentgen picture.** The deformity is usually bilateral.

The recognition of this peculiar condition is in so far of importance, as the only feasible operation, **resection** of the head of the radius, is to be recommended.

In the **differential diagnosis** between congenital and traumatic dislocation of the radius backward and outward we must take into consideration the fact that traumatic dislocation produces a limitation in motion, while congenital dislocation permits abnormally wide excursions.

INJURIES OF THE ELBOW-JOINT.

Contusions and Distortions of the Elbow-Joint.

A serious trauma of the elbow-joint will produce, first, a contusion and distortion; if, after the production of this injury, the force is not exhausted, fractures or dislocations will take place. The etiological factors are therefore the same for both kinds of injuries, which result in partly the same symptoms. The **principal symptom in contusion** is the hæmarthros and swelling. As this may be the symptom of any other injury of the elbow, the diagnosis, contusion, must not be made until all more serious injuries, especially to the bones, have been excluded. The skiagram is of great value in these cases.

Distortion.

Distortion is the result of a physiological action overdone, or of a motion which is not provided for normally, as, for instance, abduction and adduction in the elbow. The result is a tear of the ligament and capsule, which is usually exceedingly difficult to demonstrate. As most

of these injuries occur in children, it is advisable to make the **examination in narcosis.** If the injury is recent, all motions are usually painful, but if carried out slowly they are all possible passively, thus **differentiating** the distortions somewhat from a fracture, although we find that in fractures of the elbow-joint the motion is very little interfered with.

Fractures of the Elbow-Joint.

The fractures of the elbow-joint usually affect the lower end of the humerus, which injuries have been described above.

Of the fractures of the articular part of the ulna and radius at the elbow-joint, by far the most frequent is **fracture of the olecranon.** It is produced by a fall directly on the elbow and is easily recognized. The **proximal fragment** of the olecranon is pulled upward by the action of the triceps, thus producing a gap at the seat of fracture, which can be easily felt. This is, of course, more evident when the elbow is flexed. **Skiagrams** show the fracture more plainly. Not to misconstrue some of the Roentgen pictures, it is necessary to know that a **line of ossification** runs across the olecranon, and that the upper part of this bone therefore always looks torn off in children up to twelve years of age.

Fracture of the olecranon.

As soon as the diagnosis, fracture of the olecranon, is made out with certainty, immediate **operation** (bone suture) is to be recommended.

The **isolated fracture of the coronoid process** of the ulna is rare. Usually it is connected with a dislocation of the forearm backward or sideways.

Fracture of the coronoid process.

The **symptoms** of this fracture are rather indefinite. In some cases a small **prominence** is apparent in the **cubital region,** which is tender on pressure; the same pain is elicited if the patient rests his weight on the outstretched hand in supination.

The **fractures of the head of the radius** are also rare. A part of the head of the radius is pried off, and usually is connected with the bone only by the periosteum.

Fracture of the head of the radius.

The symptoms are so indistinct that it is practically impossible to make the diagnosis with any certainty, so that we have to rely on the **x-ray** picture.

The same is the case with the **fracture of the collum radii.**

Compound fractures from gun-shot or other violent injury may, of course, show any form of fracture.

Dislocations of the Elbow.

Normal function of elbow-joint.

To be able to diagnose an impairment of motion of the elbow, it is necessary to know its physiological excursion. The elbow can be flexed and straightened to an extent of 150 degrees. Frequently extension beyond the frontal plane (backward with supinated hand) can be executed. Abduction and adduction are normally not present, but it is necessary to know that in full extension the **forearm is abducted in women** more than in men. This physiological abduction may in women amount to as much as twenty-five degrees. Pronation and supination of the forearm are possible to the extent of about 180 degrees. It is well to remember that the bones of the forearm are parallel only in supination, while in pronation they are crossed.

Dislocations of the elbow are usually produced by a fall on the outstretched hand forward. They occur mostly in children or adolescents, and it may be said that where **children** or young people **dislocate the elbow, adults dislocate the shoulder.**

Varieties of dislocation of both bones.

We have to **differentiate** dislocation of both ulna and radius, and dislocation of either one of these bones.

In a descending order of frequency, **dislocation of both bones** occurs:

1st. Backward, with or without fracture of the coronoid process.

2d. Forward, with or without fracture of the olecranon.

3d. Sideways, together, either inward or outward.

4th. Each of the bones in different directions, the humerus riding between the two bones of the forearm (diverging dislocation).

Much rarer are the **dislocations of one bone,** viz., first, dislocation of the ulna backward, and, secondly, dislocation of the radius forward, backward, and outward. These latter injuries are usually combined with fractures of the other bone.

Dislocation backward.

Dislocation of the forearm backward is produced by the same mechanism as the supracondylar fracture of the humerus, and presents very much the same clinical picture if the injury comes under observation while recent. First of all, the **entire extremity appears shortened,** the joint is in slight flexion, the forearm in slight supination. The olecranon region shows a **typical deformity,** which I cannot describe better than by comparing it with the heel of a rabbit's foot. The **tendon of the triceps protrudes** sharply, and can easily be felt as an arch concave backward. In supination of the hand, the sagittal diameter

of the joint is decidedly enlarged. Frequently the free displaced articular surface of the olecranon can be felt.

The **function** of the joint is almost entirely suspended, at least actively; even passive motion is very limited.

If after complete reposition, the dislocation can easily be repeated, one has reason to assume that the coronoid process is broken.

Dislocation of both bones forward is much rarer. It is either incomplete or complete. Dislocation forward.

The **principal symptom** of the injury is a decidedly perceptible **elongation of the entire arm.** The sagittal diameter of the joint is shortened. The prominence of the olecranon is absent, and the head of the radius is to be felt about an inch farther forward than normally. In complete dislocation the arm is in flexion, forming an acute angle. If the olecranon is fractured at the same time, crepitation is to be felt in addition to the symptoms of the dislocation.

Dislocation of both bones sideways is rare. It is usually incomplete, more frequently outward, much rarer inward. It usually occurs in children. Frequently the **opposite condyle is torn off,** so that it is a question whether this accident is not necessary to make the dislocation possible. The **deformity** is so gross that it cannot evade observation or be misconstrued. The frontal diameter of the joint is much exaggerated, as well as the sagittal one. The lower end of the humerus is very prominent, as the dislocation of the forearm is not only sideways, but also upward and backward. Dislocation sideways.

Incomplete dislocation is more frequent than complete. To understand these injuries well, and to read the clinical picture correctly, it is necessary to recall the **physiological form and action.** Comparison of the sound arm is of great advantage. **X-ray pictures** are of use, except where the forearm stands in pronounced flexion, so that we can get only exposures from the profile, where the dislocated and fractured bones overlap each other so that the reading of the skiagram may become difficult. For the latter purpose it is advisable to have pictures of normal joints in different positions for comparison. Incomplete dislocation.

Dislocation of the two bones of the forearm in different directions is extremely rare. It may occur in such a way that the ulna is dislocated backward and the radius forward, or the radius outward and the ulna inward. The latter occurs only if there is a diaphyseal fracture of both bones.

Dislocation of a Single Bone of the Forearm.—Isolated dislocation of the ulna is rare. Dislocation backward is practically the same as injury Dislocation of the ulna.

of both bones, and differs only in that the radius does not follow. The **symptoms** are therefore much the same. The ulna is elongated behind the humerus, the triceps tendon can be felt as a sharp string. The empty articular surface of the olecranon can be distinctly felt. The head of the radius is more or less in place. This dislocation may be either incomplete or complete.

Dislocation of the radius.

Dislocation of the radius is also rare as an isolated injury. Any dislocation of the radius may take place, either forward or outward or backward. If there is no fracture of the radius combined with it, the **head of the latter** can always be recognized by its motion in attempts at passive pronation and supination. This is the **principal symptom** in these injuries, which must lead to the diagnosis. In all doubtful cases it will be supported by a good radiogram.

DISEASES OF THE ELBOW-JOINT.

Inflammation with serous induration is due to either rheumatic or gonorrhœal affection.

Rheumatism of the elbow is, or rather ought to be, a surgical affection, and if any decided exudations can be diagnosed, surgical evacuation ought to be recommended. If this could be done more generally, there would be less secondary ankylosis.

Gonorrhœal arthritis.

The **gonorrhœal** affection attacks the elbow-joint more rarely than other joints. Its **symptoms** usually are acute **high fever,** pronounced **tenderness** of the joint, spontaneous as well as on pressure, local heat in the same, acute effusion, and periarticular swelling. **Exploratory puncture** frequently shows the fluid beginning to get turbid after a few days, or true pus is evacuated. Frequently Neisser's gonococcus can be found, though its absence does not speak against the diagnosis. The original disease may still be in existence or healed.

Early diagnosis of the character of the disease is important, as the **prognosis** is decidedly more **infaust** for gonorrhœal affections of the joint than for any other inflammation. **Other infectious diseases,** as typhoid, scarlet fever, and the like, may affect the elbow-joint and produce the same symptoms.

Trauma may lead to **effusions** in the joint. Distortions, dislocations, etc., cause hæmarthros or serous effusion into the joint.

Suppurative inflammation of the joint may, of course, be due also to perforating wounds where infection has taken place.

Chronic Inflammations of the Elbow.

By far the most frequent cause is **gout.** Another chronic form of arthritis may be caused by the presence of **free bodies** in the joint, which are in either the posterior or anterior supratrochlear fossa. They result in a hindrance, respectively, to extension or flexion, limiting the same by from twenty to forty degrees. They produce a **grating sound** during motion, and can be diagnosed by the presence of **pain,** which occurs suddenly and frequently at different points. If a free body is present, its extirpation is to be recommended.

Free bodies.

Syphilis of the elbow-joint is rare, except in the hereditary form in children, where it produces a more or less subacute or chronic effusion in the joint.

Another form is **osteochondritis,** where an hereditary luetic inflammation along the epiphyseal line finally produces separation of the epiphysis.

Tuberculosis of the Elbow-Joint.

The clinical picture of a well-developed fungus, tumor albus, or whatever name may be given to tuberculosis of the elbow-joint, is unmistakable, but it must be our endeavor to diagnose those cases early to get better results. The tuberculous affection of the joint rarely starts primarily from the synovial membrane, but most frequently a wedge-shaped tuberculous focus of one of the articulating bones is formed, so that we have in the beginning a **tuberculous ostitis,** which becomes a tuberculous arthritis only after this process in the bone has perforated into the joint. If we therefore succeed in making the diagnosis of the tuberculous affection while it is confined to the bone, by evacuating the focus we **prevent the tuberculous affection of the joint.** The times of the typical Langenbeck resection of elbow-joints are past, and the earlier we make the diagnosis, the less mutilating our operations will be.

Early diagnosis important.

The **principal symptom** of any disease of the bone or joint is pain, which is independent of motion or exertion, and usually increases during complete rest at night. The **swelling** of the joint does not occur until either the periosteum or the capsule is affected.

It is to be hoped that we shall more regularly succeed in **photographing intraosseous foci,** as I have been able to do in a number of cases, where a skiagram was taken on suspicion of a tuberculous affection, which was proven to be present by the resulting picture.

Clinical picture and course.

The general good condition of the patient and the absence of other tuberculous affections in the same individual, do not speak against the tuberculous nature of the disease. The fever curve is atypic, and higher temperatures are observed only in the very beginning. If the case is well-developed, the **spindle-like configuration** of the joint is typical. The hand is usually held in partial or complete supination. The patient **supports the affected arm** with the other hand. If the entire joint is affected, all motions are somewhat limited and painful. Sometimes one special motion is more hindered, either pronation and supination, or extension and flexion. Frequently a certain **grating** is to be felt during motion, which is **due to tuberculous deposits** on the surface of the mucous membrane. In later stages the cartilage of the articular surfaces is destroyed, thus producing real crepitation. In still later stages the suppurative arthritis breaks through, forming **fistulæ** of significant character. Glassy granulations bulge out of the fistulæ, which bleed easily. If a sound is introduced into these fistulæ, raw bone is felt. Where fistulæ are present, **tubercle bacilli** can usually be found in the scrapings, and thus the diagnosis made absolutely certain. Where they are absent, the presence of giant-cells makes the diagnosis possible.

Differential diagnosis.

The **differential diagnosis** has to take into consideration syphilis, osteomyelitis, arthritis deformans, and neurosis of the joint, and sometimes periosteal or myelogenous sarcoma. To exclude the **syphilitic** affection of the joint, a probatory antiluetic treatment may be of diagnostic value.

Osteomyelitis, if it affects the epiphyses of the long bones, is usually multiple, while tuberculosis is unilocular.

The **neurotic affections** of the joints generally become less painful as soon as the joint is put at rest, and the pain usually subsides spontaneously during the night, while in tuberculosis the pains are rather increased at night. Sometimes a definite diagnosis can be made only during operation.

INJURIES AND DISEASES OF THE FOREARM.

Injuries and Diseases of the Soft Parts.

For obvious reasons the skin and muscles of the forearm are more exposed to injuries than any other part of the body. All these injuries are easily recognized as such, if they are only surface wounds, as produced by burns, or more complicated injuries inflicted by machinery or explosions, etc. In many cases the **outer wound** does not indicate the extent of destruction, as, for instance, in gunshot wounds in which we see only where the bullet enters and exits, and where we have to pay special attention to possible injuries to the bones, muscles, nerves, etc. Wounds.

Phlegmons of the arm usually occur as the result of infections in the fingers, in the form of **panaritium.** The lymphangitis which communicates the infection usually appears on the volar side, in the form of a red streak running upward deep in the muscles. Phlegmons might be overlooked but for the intense pain created by pressure. Inflammations.

Of **professional diseases** we might mention the chronic eczema, sometimes leading to carcinoma, of paraffin workmen, and according to our latest experiences, the burns and atrophic ulcers and finally development of carcinoma in persons who have exposed themselves unduly to x-rays.

Injuries and Diseases of the Tendons and Their Sheaths.

If a **tendon** of the forearm has been severed by an injury, this fact can usually be established by the loss of function of the muscle in question. Sometimes, however, the exact diagnosis cannot be made until during operation.

The principal disease of the sheaths of the tendons of the forearm is **tendovaginitis crepitans.** It is the result of constant overexertion, through unwonted work, or the result of professional overexertion, as in piano players. The pronator teres and the extensors of the thumb are affected with predilection. If we put the flat hand on the painful region and move the patient's hand up and down, or let him execute actively flexion and extension, we feel **crepitation** similar to the squeaking of a Tendovaginitis crepitans.

shoe, or the crackling of frozen snow. The skin above the affected region feels hot. The patients sometimes have fever. All motions are exceedingly painful.

The affection of the **bursa olecrani** we have mentioned before.

Injuries and diseases of the vessels are usually combined with other injuries. They are easily recognized by the hemorrhage, either by the spurting if an artery has been injured, or the flowing, if a vein has been severed. **Arteriovenous aneurism** may, however, show less conspicuous symptoms. Other aneurisms of the forearm are rare.

Injuries and Diseases of the Nerves.

The nerves of the forearm are either injured **directly,** in a wound where the nerves, with or without other tissues, are severed, or they are injured **secondarily,** in a fracture of the lower diaphysis of the humerus, as described above, or are affected by pressure by the **formation of callus.**

In the supracondylar fracture of the humerus and in **T** and **Y** fractures, the **median nerve** sometimes is compressed or torn; in fractures of the capitulum of the radius and the external condyle, the **radialis;** and in fractures of the internal condyle and epicondyle, the **ulnaris** may be affected.

The symptoms of the **paralysis** (partial or total) of the nerves have been described in the chapter on the arm (see page 329).

Dislocation of the ulnar nerve.

Dislocation of the ulnar nerve in the ulnar sulcus is easily recognized. The nerve, which can be felt under normal conditions in the sulcus as a distinct cord slightly tender on pressure, can easily be found in its new position, and is **unusually tender on pressure** as the result of the neuritis, with all its characteristic symptoms. As soon as the dislocation has been recognized, an operation, consisting of fixation of the nerve, is to be recommended.

Tumors of the nerves are either neurofibromas or sarcomas. As long as the tumors are small, they can easily be felt as spindle-shaped, hard nodules.

Functional symptoms are those of partial or total interruption of conduction. In the beginning, the symptoms of irritation are more prominent; later on, those of paralysis.

Professional neuritis.

Neuritis of the median nerve, besides the usual etiological factors, as multiple neuritis or central lesion, is due in a number of cases to local insults. These are either simple overexertion or special professional in-

sults, as for instance, in laundresses, who acquire by ironing a **degenerative neuritis** of the ulnar nerve, as well as of the median, which leads to disturbances of mobility and sensibility, and atrophy. The **lifting** of heavy rugs and carpets, and beating the same, have been responsible for serious injury in the median nerve. The professional neuritis in the median region is usually elicited by continuous and repeated pressure on the vola manus. Besides laundresses, carpenters and blacksmiths are affected. Dentists are also subject to it. Other trades leading to this neuritis are cigar-making, drumming, and milking.

Infectious diseases, like typhoid fever, may be responsible for acute isolated paralysis of the median nerve.

Differential diagnosis.

For **differential diagnosis** we have to mention that the median nerve is paralyzed in many cases, as a **part symptom of a central lesion,** either of the brain or the spine. The atrophic and paralytic condition of the small muscles of the hand indicates a spinal progressive muscular atrophy, or one of the paralyses which occur in lead or arsenic poisoning. If the **median nerve has been injured** on the volar side of the forearm near the wrist, flexion of the hand and the fingers, as well as pronation, is not interfered with. If the tendous are cut at the same time with the nerve these motions are, of course, suspended.

The **principal symptom** of these injuries of the median nerve in its distal part is the paralysis, and later on atrophy, of the muscles of the ball of the thumb (thenar), and sensory disturbances. The latter are rather complex, owing to the frequent **overlapping** of the regions pertaining to the median, ulnar, and radial nerves. It may suffice to say that the vola proper and the thenar in its largest part are **innervated** with sensory fibres of the median nerve, as are also the volar parts of the thumb, index, and middle finger, and the volar radial part of the fourth. Electric muscular sensibility is lost. Frequently the sensory disturbances are lacking completely (*sensibilité recurrente* or *supplée*).

The atrophic disturbances affect especially the ball of the thumb.

The **vasomotor disturbances** in the fingers produce the following symptoms:

Vasomotor affections.

The fingers are cool to the touch, either pale or livid, frequently covered with hair, and do not perspire. The skin of the affected region is easily injured by slight pressure or touch, producing excoriations resulting in ulcers. The glossy skin of the fingers has been mentioned above. Besides ulcers, herpes and pemphigus-like blisters are formed. The nails show many deformities.

Paralysis of the Ulnar Nerve.

Causes.

Professional causes for paralysis of the ulnar nerve are either over-exertion of the small muscles of the hand, or direct pressure exerted on the nerve or on the small muscles of the hand. It occurs in laundresses, cigar-makers, hat-makers, watch-makers, metal-turners, and engravers.

Fractures and dislocations, with their abnormal formation of **callus** near the elbow-joint, are frequently responsible for injuries of the ulnar nerve.

Injuries where the nerve is simply severed, especially by a fall into glass, tin, etc., are frequent. The symptoms of paralysis of the nerve have been described in the chapter on the arm (see page 331).

Vasomotor symptoms.

Of the **vasomotor and atrophic symptoms,** atrophy of the interossei is best known, producing a wasting in the metacarpal spaces. Diminished resistance against light insults, as described in paralysis of the median nerve, occurs also in lesions of the ulnar nerve.

Dupuytren's contraction is due probably in many cases to neuritic conditions of the ulnar nerve.

For **differential diagnosis** it is necessary to know the clinical picture of the so-called **hook-hand** (*main en crochet*) which is a professional disease of glass-blowers. The deep flexors of the fifth and fourth, and sometimes also third and second fingers (nearer the thumb), are contracted, from holding and rotating the heavy iron tube, which is very hot. This affection has nothing to do with the ulnar nerve, in spite of the similarity of the contraction of the palmar fascia.

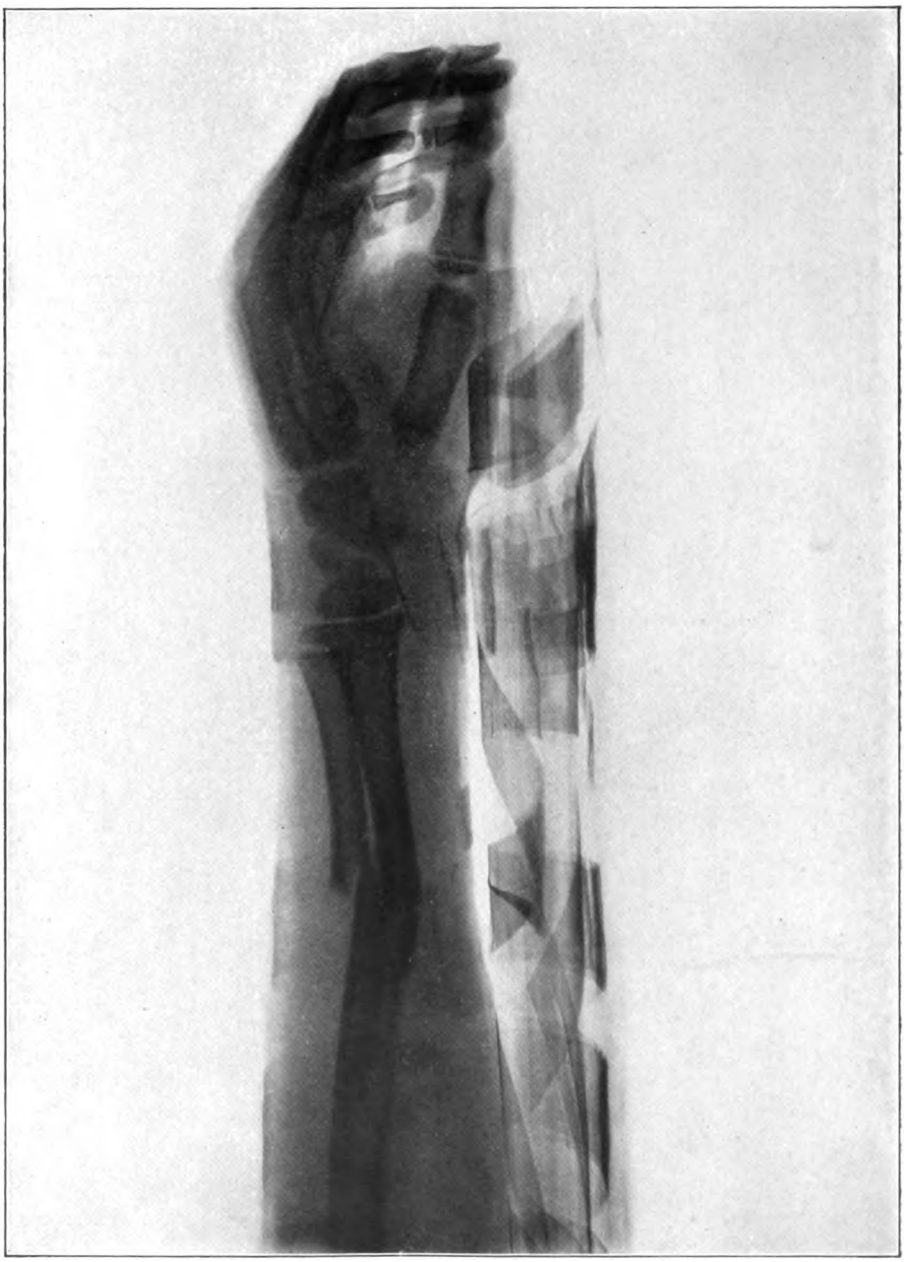
Paralysis of the Radial Nerve.

The paralysis of the radial nerve in its upper course, occurring with sleep paralysis, narcosis paralysis, Esmarch's bandage paralysis, crutch paralysis, etc., has been described (see page 329).

Causes.

Among the insults in the more distal course of the radial nerve, producing paralysis, we have to mention **subcutaneous injections** of ether under the skin of the forearm.

The contractions and symptoms typical of radial nerve paralysis have been described above.



FRACTURE OF FOREARM (on a Splint).

Both bones broken below the middle. Note absence of outer deformity, in spite of malapposition.

FRACTURE OF ULNA AND RADIUS (Latter not Visible).
Ischæmic paralysis of muscles of forearm.

FRACTURE OF ULNA WITH PSEUDARTHROSIS.

INJURIES AND DISEASES OF THE BONES OF THE FOREARM.

Congenital Deformities.

Besides complete **absence of the forearm,** the radius as well as the ulna may be entirely or partly lacking. Where the **radius is lacking,** we find in marked cases total **displacement of the hand** toward the radial side of the forearm (radial adduction), **absence of the thumb** and its corresponding metacarpus, absence of the carpal bones on the radial side; on the humerus there is no radial articular surface, nor a sulcus inter-tubercularis. The entire group of radial muscles, the supinators, and the muscles of the thumb, are absent. The defect is frequently bilateral. If the defect of the radius is **partial,** in most cases the lower end is lacking, and very rarely the upper.

The **defect of the ulna** is much rarer. The hand is in a position between pronation and supination, and shows ulnar adduction. Motion is little interfered with, except in the elbow-joint.

Fracture of Both Bones.

Site of fracture.

It is usually the result of **direct force;** the bones generally break in the middle of the forearm about in the same plane. If produced by **indirect force,** the radius breaks in the middle, the ulna at a point usually a little lower, corresponding to the weakest points of the respective bones.

In many cases there is little or no displacement, and without the aid of the **x-ray picture,** the diagnosis has to be based on the local pain. The patient, if conscious, supports the fractured member with his other hand, and even if there is but little deviation, one can observe that the weight of the arm produces a **certain deformity,** though it may be ever so slight. Where the displacement is pronounced, the injury is self-evident.

Resulting deformities.

It is necessary to know that during the course of healing, twofold difficulties may occur: **pronation and supination** will be interfered with, which may be either the result of too profuse production of callus, or of the formation of an interosseous bridge, or due to an angular deformity of one of the fractured bones. The other complication is the formation of **pseudarthrosis,** due to the interposition of soft parts. The prognosis of pseudarthrosis is not good, as operations for this condition are frequently without result.

Isolated Fractures of the Ulna.

They are nearly always produced by direct force; frequently the fractures are compound.

Isolated fracture of the ulna by indirect force is combined with dislocation of the head of the radius.

Isolated Fractures of the Radius.

The radius is fractured by **direct force** in the diaphysis, when there is practically no displacement; nevertheless the diagnosis is easy, especially with *x*-ray picture.

Colles' fracture.

Indirect force, a fall on the outstretched hand, produces **Colles' fracture.** It occurs most frequently between the fiftieth and sixtieth years, then between forty and fifty, then between one and ten, while from the tenth to the thirtieth year the fracture is rarer. In children the fracture not infrequently occurs in the form of a separation of the **epiphysis.** The usual etiology is a fall on the outstretched hand. If the fracture is complete, the distal fragment (and with it the hand) is dislodged toward the dorsum, the proximal fragment toward the vola. The **deformity is so striking** that it cannot be mistaken, after it has once been seen.

But besides this deformity, which is usually called a "silver-fork" fracture, there is **another displacement,** bayonet-like, which brings the hand in radial adduction and radial flexion, so that the axis of the forearm in supination no longer runs through the third, but the fourth finger. This causes the distal end of the ulna to protrude strongly; frequently it appears to be dislocated. After a short while the **swelling** is rather pronounced, and may to some extent cover the deformity. On the volar side, dark bluish **suggillation** is characteristic, while abnormal mobility and crepitation are usually lacking. There is violent pain; the hand is useless, without power, and cannot be pronated or supinated.

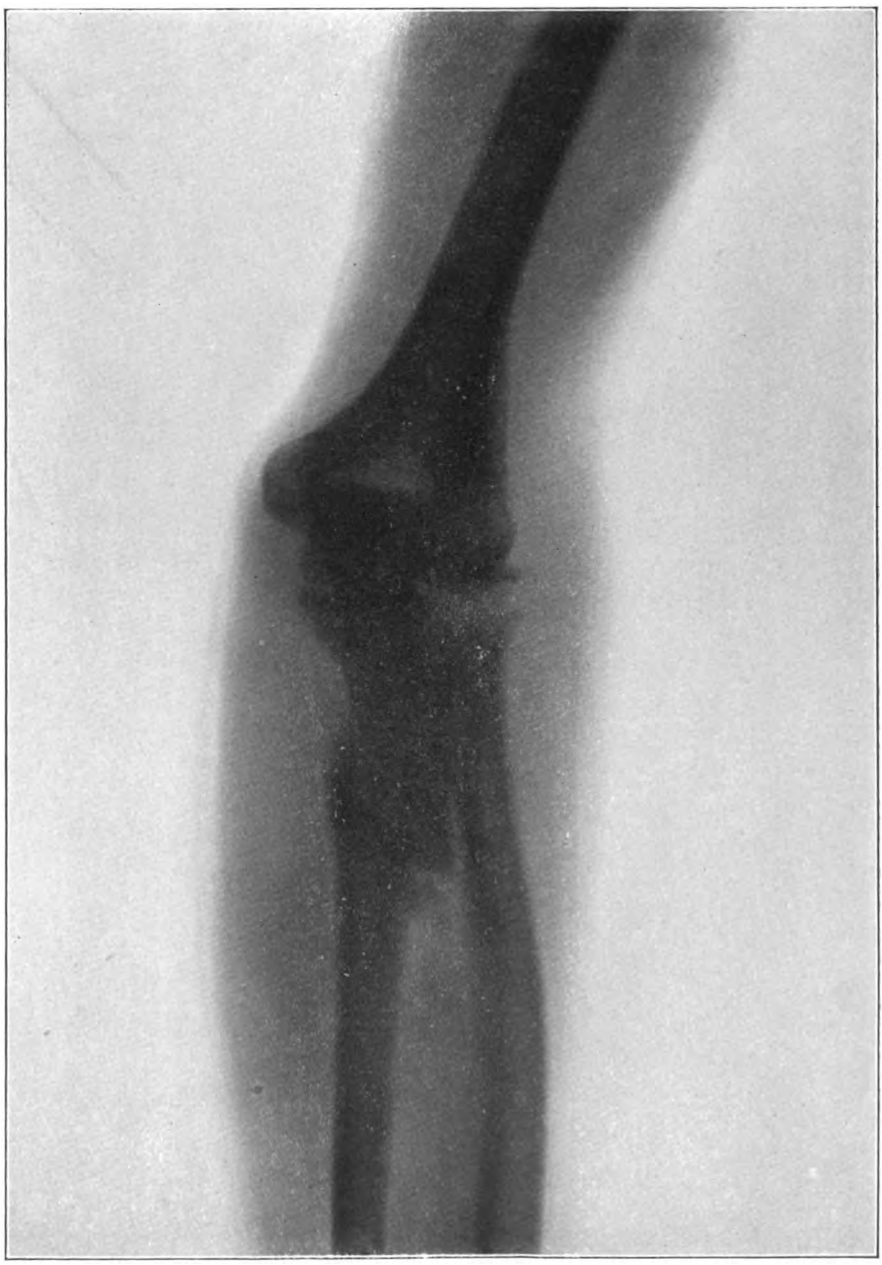
Differential diagnosis.

For **differential diagnosis** we have to distinguish fracture from distortion of the wrist. In **distortion,** the joint itself is painful on pressure in a frontal direction, while in **fracture** the point of pain is half an inch or more behind (proximal) the line of the joint. If there is any doubt, a **Roentgen picture** will solve it. After all it is generally safer to assume a fracture, the more so as a pure distortion, without impaction or fissure, is rare.

FRACTURE OF ULNA ABOVE THE MIDDLE.
Note nuclei of ossification in child.

FRACTURE OF ULNA WITH DISLOCATION OF HEAD OF RADIUS.

Causing radial paralysis by pressure upon radial nerve. Relieved by operation. Side view.



FRACTURE OF ULNA WITH DISLOCATION OF HEAD OF RADIUS.
Front view of case of Plate XXXII.

EPIPHYSIOLYSIS OF RADIUS IN A BOY OF TWELVE.

Front view of case of Plate XXXIV. Note normal epiphyseal lines in other joints.

EPIPHYSIOLYSIS OF RADIUS IN A BOY OF TWELVE.

Fall upon outstretched hand. Fracture could not be detected by fluoroscope. Note dorsal prominence of broken-off disc.

FRACTURE OF RADIUS (COLLES' FRACTURE).

Rare volar displacement of distal fragment. Fall upon hand in flexion.

Even with proper treatment, the **prognosis** in older people at least is doubtful (*quoad functionem*). The prognosis depends largely upon the fact whether the fracture is **extra- or intra-articular.** The most frequent complication is the breaking off of the styloid process of the ulna.

In **rare cases** the dislocation of the fragments happens in the opposite way, so that the proximal ends are dislodged toward the dorsum, and the distal fragments with the hand toward the vola.

Clinically the picture resembles very much a volar dislocation of the hand, and if there is any doubt it is safer to take a **Roentgen picture.** As the injury is comparatively rare, I show a skiagram of one of my cases.

Diseases of the Bones of the Forearm.

All the chronic and acute forms of **inflammation of the periosteum** and **the bone** occur in the bones of the forearm. But they are all **rare, except osteomyelitis,** which occurs quite frequently. Whether the inflammation is due to tuberculosis, syphilis, or osteomyelitis, has to be decided according to the respective general symptoms, which have been described frequently in other chapters on diseases of the bones.

The **functional symptoms** depend upon the fact whether the disease in question attacks the diaphysis or the epiphyseal end, where the **infection of the neighboring joint,** either the wrist or the elbow-joint, is probable.

Osteomyelitis.

Acute osteomyelitis usually leads to the formation of a **sequestrum,** which sometimes involves the entire bone. The swelling and thickening are first confined to the bone itself, while after perforation of the periosteum the surrounding soft parts become infected. The **general symptoms** are in acute cases high fever, local tenderness, spontaneous as well as on pressure, and violent piercing pains, especially at night.

Tumors.

Among the **tumors** of the bones of the forearm, which are comparatively rare, sarcomas are most frequent. They occur in both forms, periosteal as well as myelogenous. The character of the tumor is made probable by its **rapid growth and its hardness.** The bony tumor with smooth surface can be felt directly under the skin, covered eventually only by a thin layer of atrophied muscles. In case of doubt, **exploratory excision** for microscopic examination is in order. We must not forget, however, that in all cases of malignant tumor, where a piece has been excised for diagnostic purposes, the **radical operation must follow** as soon as possible, as the preparatory excision seems to stimulate the tumor to especially rapid growth.

INJURIES AND DISEASES OF THE HAND AND FINGERS.

CONGENITAL DEFORMITIES OF THE HAND AND FINGERS.

All the deformities to be described are interesting not only from an embryological, but also from a practical surgical point of view, because the function of the hand is often seriously impaired, and can usually be decidedly improved by surgical interference.

According to whether there are too many or too few fingers, or whether or not they are grown together, we discriminate between polydactylism, ectrodactylism, and syndactylism.

Polydactylism.

Polydactylism is by far the most frequent. It is often inherited, and can be traced through a number of generations. Its commonest form shows **six fingers** on either one or both hands; they are regularly formed and have the proper articulations and tendons. They usually do not at all interfere with the use of the hand, and the extra digit is removed only for cosmetic reasons. The number may be increased to **seven or even twelve on one hand.** In such cases, the supernumerary fingers are usually poorly developed and crooked; they interfere greatly with the use of the hand.

Besides these regularly developed supernumerary fingers, the deformity may occur in a more irregular form, the extra finger appearing as a mere appendage.

Bifurcation of the hand is so rare that it suffices to mention it. The form of the anomaly is expressed in its name.

Ectrodactylism.

Ectrodactylism is a deformity in which some or all the fingers are absent. Frequently it is combined with abnormal or arrested development of the entire extremity. I show a skiagram of a very interesting malformation (perobrachium), which was bilateral, in Plate XXXVII. Strange to say, in spite of this striking deformity, the man selected watchmaking as his trade. In some cases the ectrodactylism is incomplete, the fingers having been partly or entirely amputated by amniotic bands (so-called **spontaneous amputation**).

PEROBRACHIUM WITH ECTRODACTYLISM.

Joint above middle of picture is elbow; above, wrist, with two carpal bones and a normally developed thumb and finger.

REVOLVER BULLET (CALIBRE 22) IN HAND.

Syndactylism shows three grades. The fingers are simply webbed, or the soft parts are grown together, or there is bony union between the fingers. All these deformities are easily recognized when seen, and are of great importance, as proper surgical treatment (sometimes very difficult) is attended by good results. Syndactylism.

Polydactylism, ectrodactylism, and syndactylism may be combined.

The **thumb,** according to its special anatomical development, shows peculiar deformities. Ectrodactylism of the thumb is usually combined with congenital defect of the radius. Deformities of the thumb.

Supernumerary thumbs may have two phalanges, but are usually smaller than the normal one. They are ordinarily inserted on and articulate with the first metacarpal bone.

Quite different is the **cleft thumb,** in which the two thumbs are parallel. The differentiation is important, because this latter form does not offer any impediment in function, while the supernumerary thumb must be exarticulated or amputated.

Thumbs with three phalanges may also be seen. Finally, I may mention a deformity in which the **thumb forms a right angle** with the metacarpal bone.

FRACTURES AND DISLOCATIONS.

Dislocation of the Hand.

It is very rare; doubtless many of the unusual forms of Colles' fracture have been mistaken for dislocation of the hand. The **typical form** shows the dislocation of the hand toward the dorsum, while the dislocation toward the vola is even rarer. The deformity is not unlike that of Colles' fracture, but it is **located half an inch** to an inch more distally. The bayonet-deformity is lacking, and the styloid processes can usually be felt and seen in the axis of the respective bones, with no angular bend. In some cases the articular surface of the radius can be felt from the vola. Any doubt is easily solved by the **skiagram.** Differentiation from Colles' fracture.

The **isolated dislocation** of ulna or radius is so rare that it must suffice to mention it.

Fractures of the Carpus.

A typical injury is the isolated **fracture of the scaphoid,** which results from a fall on the hand in dorsal flexion and ulnar adduction, if the forearm is in a perpendicular position during the fall. There are no crepitation and no deformity. Fracture of the scaphoid bone.

The **principal symptom** is the effusion in the joint, and pain on pressure in the radial foveola. The skiagram shows the fracture easily.

The other fractures are very rare, except where compound fractures, especially as a result of bullet wounds, etc., occur.

Another typical injury, though rare, is a **fracture of the os naviculare,** with dislocation of the os lunatum.

The isolated **dislocations of carpal bones** are also extremely rare, and are best recognized by the *x*-ray picture.

Fractures of the Metacarpal Bones.

They occur most frequently in the thumb and the fifth or index finger, as these bones are more exposed than the others. The fracture is **typical in the metacarpus of the thumb:** the volar part of the proximal end of the metacarpus breaks off, thus permitting the other part of the metacarpal bone to slip backward toward the wrist, which may then give the impression of a dislocation of the metacarpal bone toward the carpus.

Fracture of the metacarpus of the thumb.

Fractures of the phalanges are so striking that they cannot be mistaken for anything else.

Dislocation in the carpometacarpal joint is extremely rare. Its diagnosis, as soon as swelling has set in, is possible only by means of a skiagram.

Dislocation in the Metacarpophalangeal Joints.

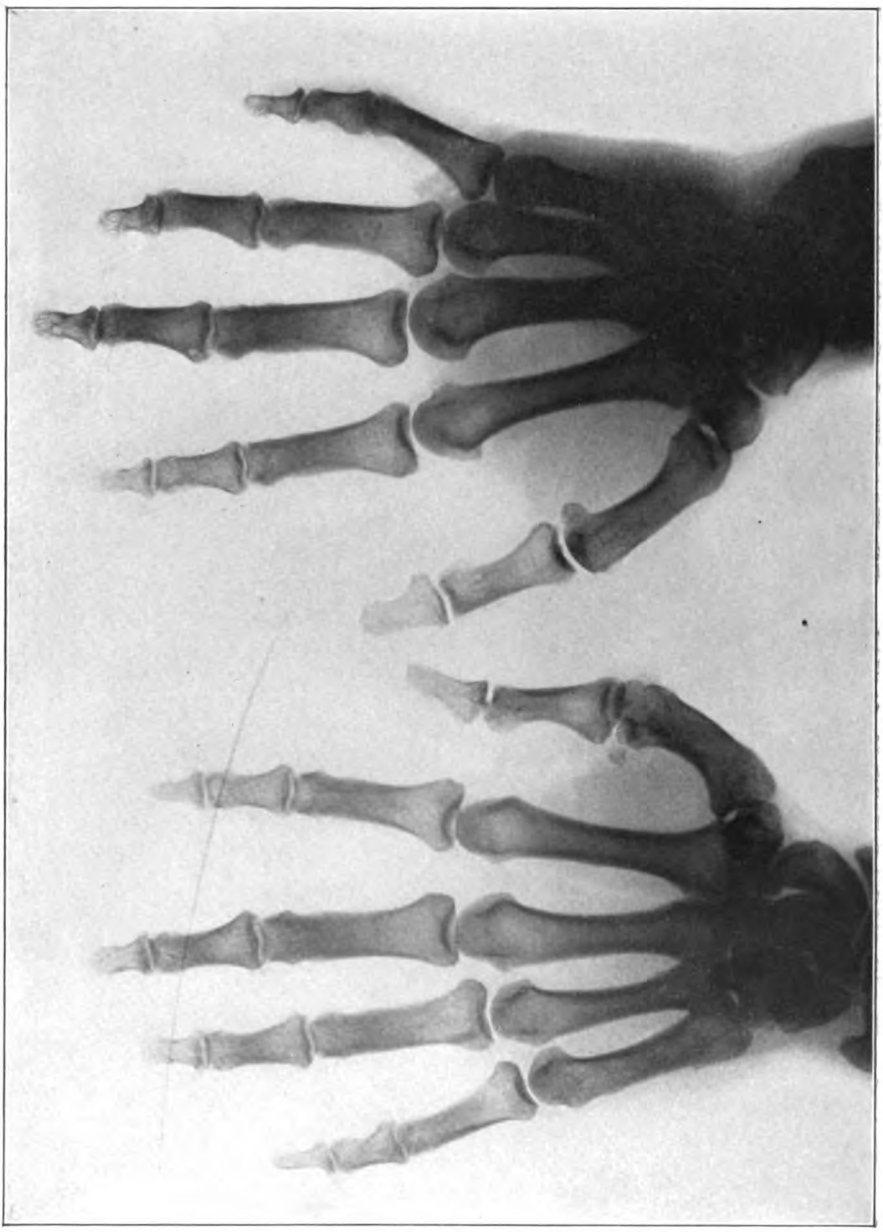
Of these injuries by far the most frequent is the **dislocation of the thumb.** According to their frequency, we differentiate dorsal, volar, and lateral dislocations, of which the first is the typical injury. The **deformity is striking** in the incomplete, as well as in the complete form.

Dorsal dislocation of the thumb.

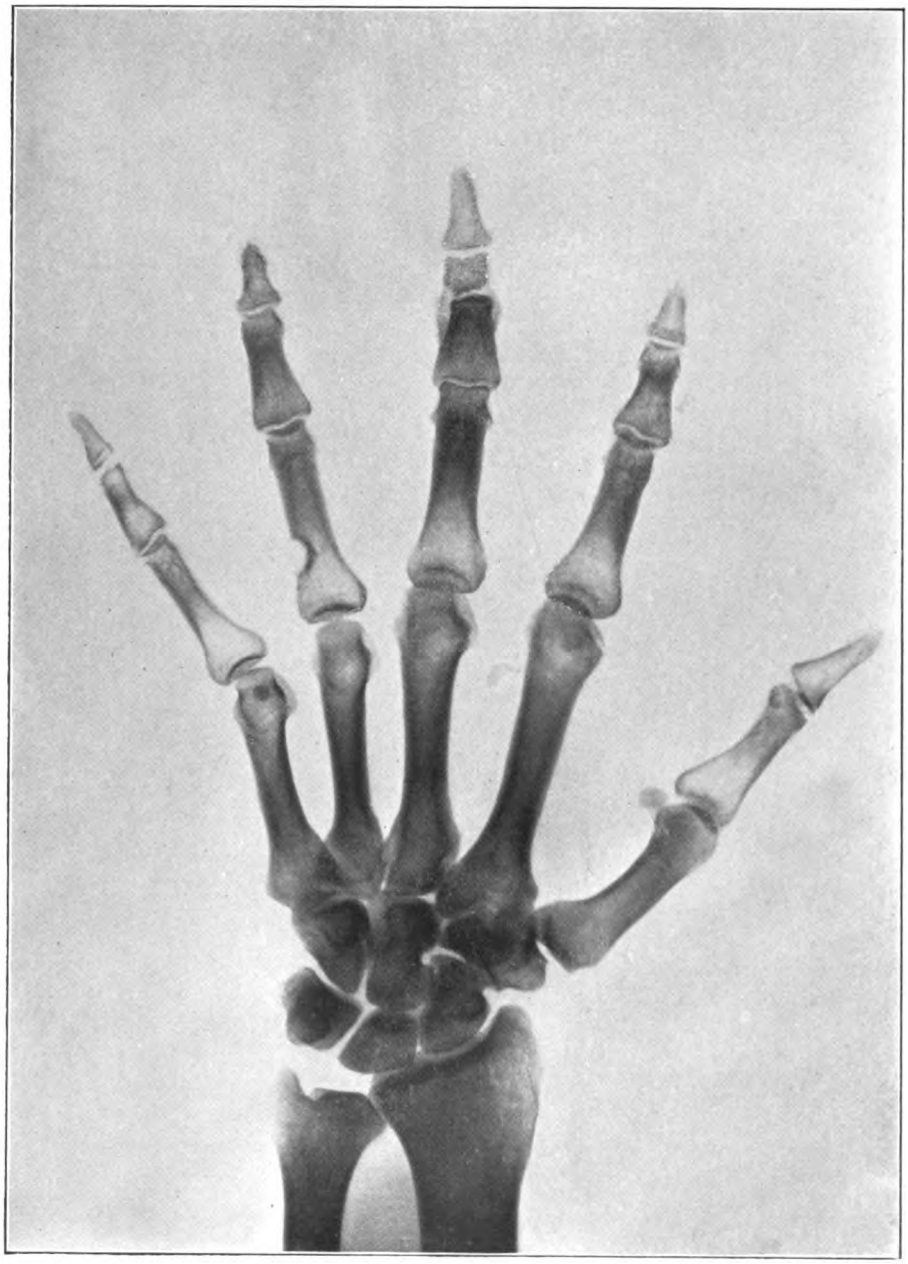
The thumb presents the figure of a capital Z. The basal phalanx stands at a right angle to the metacarpal bone, and the distal phalanx is in the same position in reference to the basal. The head of the metacarpal bone can be felt just beneath the skin in the thenar eminence. This must not be mistaken for the articular surface of the basal phalanx. It is easy to feel one's way, if one will remember that the distal articular end of the metacarpal bone is convex, while the proximal end of the basal phalanx is, of course, concave.

Examination by palpation and attempts at reduction must be carried out with **extreme care,** to prevent the formation of the so-called **complex dislocation,** where the outer sesamoid bone is caught and twisted at the

FRACTURE OF METACARPUS OF INDEX FINGER.



FRACTURE OF FIFTH METACARPAL BONE
of right hand, with pronounced periostitis simulating tuberculosis.



FRACTURE OF SECOND PHALANX OF MIDDLE FINGER.

Skiagram shows unsuspected defect in proximal phalanx of ring finger. Tabetic patient.

COMPOUND DISLOCATION OF DISTAL PHALANX OF THUMB.
Fall upon extended thumb.

same time between the phalanx and the metacarpus. If this happens, the axis of the entire thumb is apparently normal, but in reality the phalanx stands **parallel to** the metacarpal bone on the radial side of it. The metacarpophalangeal joint is therefore extremely broadened. Complex dislocation.

The *x*-ray picture easily explains the anatomical conditions.

The **volar dislocation** of the thumb is, as said above, extremely rare and easily recognized. The dislocation is just the opposite to a dorsal dislocation.

The lateral dislocation is so rare that I only mention it.

Dislocation of the Fingers in the Metacarpophalangeal Joints.

They are not quite so rare as appears from the statistics, doubtless because a great many of these injuries are adjusted by the patients themselves. Ball-playing especially is responsible for these injuries. The **typical dislocation** is toward the dorsum. The finger seems shortened, it stands in flexion, extension, or hyperextension. The metacarpal head can be felt in the vola, the concave articular surface of the proximal end of the phalanx on the dorsum. The volar dislocations are extremely rare, and present the opposite picture. Dorsal dislocation.

Dislocations in the interphalangeal joints are quite frequent, and so easily recognized that they present no difficulty. The dislocation may be either lateral or toward the dorsum or vola. If the dislocation is not complete, the deformity is less pronounced, but the hindrance in motion will lead to the diagnosis.

DISEASES OF THE WRIST AND HAND.

Inflammations of the Wrist.

The acute inflammations of the wrist are quite frequent. The largest contingent is furnished by **acute rheumatism** (polyarthritis rheumatica). In many cases this is decidedly a surgical disease, and ought to be treated as such. Furthermore, we should know the clinical picture for **differential diagnostic** purposes. Many of the so-called rheumatic affections of the wrist, especially if they are monarticular, are doubtless of **gonorrhœal origin.** The latter occurs either in the fourth week, or two to four months after the original infection. When the articular process exists in the later stages, it sometimes is the result of treatment of the Rheumatic and gonorrhœal affections.

original disease with instruments or injections. The **early recognition** of the character of the disease is important, because it demands an immediate suspension of any urethral treatment. Frequently the sheaths of the tendons are affected.

Septic infection of the wrist, either from wounds of the hand or phlegmons, or as a metastatic process in pyæmia or other general infectious diseases, needs very prompt recognition.

Symptoms. All these three forms of acute inflammation of the wrist are accompanied by high temperatures, intense pain, effusion of the joint, and redness of the skin. Any voluntary motion of the wrist is anxiously avoided as extremely painful. The affected region is hot to the touch.

In cases where **suppurative effusion** can be expected, as in gonorrhœa and septic forms, **exploratory puncture** with a needle (not too fine) is to be recommended. The puncture of the wrist is made by introducing the needle in a frontal direction just beyond (distal) the styloid process of the ulna.

Osteomyelitis of the distal end of the radius may produce secondary effusion of the joint. The same is possible if the carpal bones are affected by osteomyelitis.

Chronic forms. The **chronic inflammations** of the wrist are due to chronic articular rheumatism, arthritis deformans, gout, tabes, syringomyelia, and tuberculosis.

Chronic rheumatism of the wrist is recognized by being multilocular, and by the absence of the doughy infiltration of the soft parts.

Arthritis deformans is much more frequent in the small interphalangeal joints. The same is the case with gout.

In **neuropathic** joint diseases, the wrist is quite frequently affected.

In **tabes and syringomyelia** the swelling of the joint is usually painless, and the thermo-sensibility impaired or entirely suspended. In later stages the cartilage of the articular ends is destroyed, producing crepitation. By that time the capsule of the joint may be so distended and loose that spontaneous dislocation or subluxation may occur. The periarticular region is affected in a pronounced way.

In tabes the deforming changes occur much more rapidly than in syringomyelia.

Differentiation. **Syphilis** of the joint, though rare, must be excluded. Frequently the exact diagnosis is not possible until operation, or until a fistula is formed, when the mouth of the **fistula** assumes the pronounced character of a

syphilitic ulceration, and granulations scraped off do not show a tuberculous affection of the tissue, with which it might be confounded.

Tuberculosis of the Wrist.

This is rare in children, but frequent in middle and later life. Often other tuberculous affections, especially in the lungs, are to be found. The tuberculosis of the joint may assume different forms, which depend upon whether the primary affection was osseous or capsular.

Local symptoms.

The development of tuberculosis of the wrist is slow, with little pain. Usually the impairment of function first becomes apparent. At the same time the muscles of the forearm become atrophied. If there is a **circumscribed focus** in the bone, that place is usually tender on pressure. In more diffuse affections, we recognize the clinical picture of the **tumor albus,** the spindle-form thickening of the entire joint. Doughy œdema of the skin occurs, the fingers become more and more useless from the affection of the sheath of the tendons; finally the process shows a tendency to perforate.

For early diagnosis the skiagram may be of value, to show an isolated focus.

Inflammations of the Bones and Joints of the Hand and Fingers.

All the affections of the joint named above, chronic articular rheumatism, arthritis deformans, gout, lues, tabes, syringomyelia, and tuberculosis, may affect the small joints of the hand and fingers, or their constituent bones.

Interesting are the **multilocular diseases** of the bones and joints of the hands in children with hereditary **lues.** In tertiary syphilis, dactylitis, chondritis, and periostitis luetica simplex are typical.

Spina ventosa.

In **tuberculosis of the bones and joints** of the middle hand and fingers, **spina ventosa** is exceedingly characteristic. It is easily recognized as a gourd-like thickening if it attacks the phalanges, while the disease in the metacarpal bones may be harder to recognize, but here the **skiagram** will be of great value. Frequently several of the metacarpal bones are affected at the same time. The formation of the tumor is without pain, the soft parts covering the bone are infiltrated, producing a doughy swelling on top of the cyst-like expanded bone. If the cortical portion is thinned out to the extreme, spontaneous fractures may occur.

DISEASES OF THE SOFT PARTS OF THE HAND AND FINGERS.

Acute Inflammations of the Hand and Fingers.

Infection occurs after a lesion of the skin, which is, of course, exposed to many insults during work.

Inflammations of the palma more serious.

All the different forms of acute **inflammation by infection,** from the simple felon to violent phlegmons, are of more importance if they occur on the palmar side than on the dorsal. Their recognition is self-evident, and we have only to mention that it is wrong to wait for the symptom of precise fluctuation, which is very deceptive in any case, especially in the finger-tips.

The **differential diagnosis,** according to the rules of older surgery, between cutaneous, subcutaneous, tendinous, periosteal, and articular **panaritium** is frequently impossible and unnecessary.

The depth of the infection is easily recognized during operation, which cannot be performed too soon.

Another infection, the furuncle (due to infection with staphylococcus) occurs in the hand and fingers only on the dorsal side.

Malignant pustule.

Of importance is **pustula maligna.** As well known, it occurs by direct infection, as a rule only in men who handle skins or leather. The clinical picture is striking, showing a black necrotic ulceration, with pronounced infiltration around it. The definite diagnosis depends upon the microscopical examination in experimental infection in animals.

Luetic primary lesion has been observed on the fingers, and may be mistaken for other infections, owing to its unusual location.

Erysipelas of the hand and arm is much rarer than that of the leg or other parts of the body. It shows its usual **typical symptoms,** rapid spread of vivid reddening of the skin, sometimes with formation of blisters, and generally accompanied by exceedingly high temperatures with no remission, except when the erysipelas apparently subsides. With the next onset the temperature goes up again.

Tetanus.

Tetanus must be mentioned, as this infection seems to be on the increase in this country. The original lesion may be very small. The infection, so far as known, takes place only after contact with garden-soil, or after injuries with blank cartridges.

Tetanus infection, of course, can be recognized only by its **general symptoms,** local symptoms being entirely absent.

Burns and congelations show the typical symptoms of similar injuries in other parts of the body, and are easily recognized.

Chronic Forms of Inflammation.

Etiological factors are tuberculosis, syphilis, diabetes, lepra, syringomyelia, injuries of peripheral nerves, and carbolic acid poisoning.

Tuberculosis.

Tuberculosis may attack the soft parts of the hand in different forms, either as tuberculosis of the skin, as tuberculosis verrucosa, or as **lupus.** The latter has a tendency to mutilate the hand so that the entire phalanges may be lost, resulting in a grotesque deformation of the hand.

The recognition of the **tuberculous character of the ulcers** is sometimes not easy. In doubtful cases, excision of a small part for microscopical examination, and possibly inoculation in animals, will have to decide the question. The excised parts rarely show tubercle bacilli, but enough giant-cells to guarantee the diagnosis.

The ulcers resulting from **injuries to the peripheral nerves** are of atrophic nature, and can be recognized as such if the injury to the nerve is known.

Gangrene.

Gangrene and necrosis on a diabetic basis are of such importance that examination for sugar ought not to be omitted in any case where the nature of the ulcerative affection of the hand is doubtful. The ulcer usually starts from a small, frequently unobserved injury, like a contusion or little wound.

Carbolic acid gangrene does not show any special clinical features, and one has to base the diagnosis on the etiological fact that carbolic acid has been used. It is necessary to know that solutions, even as weak as one per cent, if applied in the form of a wet dressing for twenty-four hours, have produced extensive gangrene. Stronger solutions up to five per cent have caused gangrene even when they were applied from three to four hours only. Undiluted carbolic acid, as sometimes used by ignorant patients, may produce dry gangrene in a very short while, as a certain idiosyncrasy doubtless exists in some persons.

Tendovaginitis.

The sheath of the tendons of the hand is sometimes attacked by **acute tendovaginitis,** similar to that of the forearm. The **chronic form** of tendovaginitis is in most cases **caused by tuberculosis.** It attacks the volar tendons more frequently than the dorsal, and if finally the common pouch of the tendons is infected on the volar or dorsal side, or both, the tense, slightly fluctuating tumor is rather striking. Frequently the ligamen-

tum carpi commune volare divides the **hygroma in two parts,** which communicate with each other, so that the contents of one can be pressed into the other. Its form can be compared to that of a "lady-finger" (*zwerchsack* hygroma). In many cases **oryzoid bodies,** either free or still in connection with the capsule, like polyps, are found in these hygromas. The tuberculous character of this affection is proven beyond any doubt. As soon as the tuberculous tendovaginitis or hygroma has been recognized as such, immediate complete **extirpation** of the sheath of the tendons is to be recommended.

For **differential diagnosis** we have to take into consideration gonorrhœal tendovaginitis, which usually occurs only in connection with infection of the neighboring joint. The infiltration is much more diffuse, the surrounding soft parts show œdema, and in contrast to the tuberculous affection, the gonorrhœal tendovaginitis is extremely painful.

Tumors of the Hands and Fingers.

Ganglion.

Though **ganglion** is in no sense a tumor, I mention it here because it is mistaken so frequently for one. It is a **hernia of the sheath** of the tendon filled with synovia, which becomes thickened. The place of predilection is on the dorsum of the wrist. If the hand is in volar flexion, the ganglion is to the touch as hard as cartilage. If the hand is in dorsal flexion, the tension is relaxed and fluctuation can sometimes be felt. In a number of cases the cyst is plainly movable. There is no pain connected with it, and the only discomfort is a certain weakness in the hand, which tires more easily than usual.

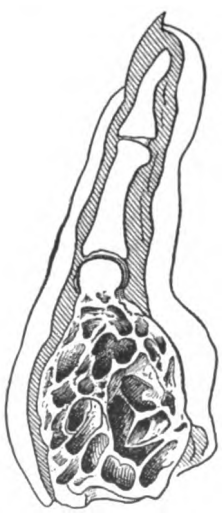


FIG. 30.—Myeloid Sarcoma of the Basal Phalanx of the Index Finger.

Extirpation of the sac is to be recommended as the only rational treatment (the cyst is in direct open connection with the sheath of the tendon, therefore the operation requires most careful asepsis).

Another frequent affection of the hands and fingers are **warts.** They are doubtless due to hypertrophy of the epithelial cells, although their true nature is entirely unknown, as well as why and how the indubitably established fact of self-inoculation occurs.

Tumors.

Cavernous tumors occur on the fingers, though not very frequently.

They are easily recognized by their dark blue color (at least in some cases) and their compressibility.

The other **benign tumors** are rather rare, viz., fibroma, lipoma, atheroma, but not multiple enchondromas. The latter are easily recognized by their bone-hard consistency and spheric or hemispheric form, with perfectly smooth surface.

Neuromas, due to former insults to the nerves, occur on the fingers and hands as well as on the forearm, where we have described them.

Sarcomas occur in the soft form as spindle-cell or round-cell sarcoma, as well as in the form of **myeloids.** While the former are exceedingly malignant, the latter must be classed among the comparatively benign tumors. As they are not very frequent, I show here a drawing from one of my cases.

Carcinomas of the extremities are rare, but comparatively most frequent on the dorsum of the hand. They show the typical ulceration of carcinoma.

Contractions.

Contractions of the hand and fingers may be the result of **congenital** shortening of the palmar skin. In other cases **traumatic scars** of the skin may produce contractions.

Contraction of tendons.

The **tendons** may cause a contraction of the fingers, if either the tendons or their sheath have been shortened and become adherent after inflammatory processes, or if the antagonists have been paralyzed. The **operation** to be recommended depends upon the profession of the patient. Plastic operations are permissible where the patient has not to do any serious work with his hand. For the workman and laborer, exarticulation of the finger with eventual resection of the head of the carpus is much more rational.

Writers' cramp is a spastic contraction of the hand, which usually occurs only when the patient endeavors to write. It may show itself either in the spastic cramp which prevents the use of the hand, or in a more paralytic form with an inability to hold the pen, or the cramp is connected with a pronounced tremor. The best treatment to be recommended is the use of a typewriter.

Dupuytren's contraction.

Dupuytren's contraction is the result of a contraction of the palmar fascia. As long as the fingers are not drawn entirely into the palm (some-

times so that the nail penetrates the skin), one can easily see the ridges of the palmar fascia leading to the basal phalanges of the fingers. It is a well-known fact that this contraction occurs frequently in several members of one family. As soon as the disease is recognized, partial or total **extirpation** of the palmar fascia should be recommended.

INJURIES AND DISEASES OF THE LOWER EXTREMITIES.

INJURIES AND DISEASES OF THE HIP-JOINT.

Congenital Dislocation of the Hip.

This is nearly as frequent as congenital club-foot. Girls are much more affected than boys. In one-third of the cases the dislocation is bilateral. Apparently the dislocation of the left side is more frequent than that of the right side. Heredity seems to be of importance. Since the attention of physicians has been called to this quite frequent disease, it is to be hoped that the diagnosis will be made **before the children walk,** although the deformity is at that time much less pronounced. Anamnestic inquiries, if any unusual occurrences happened during pregnancy or childbirth, are usually answered in the negative. When the children are born, there is generally only a subluxation of the limb. Therefore the deformity, if **bilateral,** is not so obvious to the eye, but by palpation we can easily find the unusual laxity of the joint, which permits a forcible movement of the head of the femur forward to a certain degree.

Diagnosis should be made early.

If the affection is **unilateral, a shortening,** even if slight, of the affected limb can usually be demonstrated. These children ordinarily do not walk until they are a year and a half or two years old, and by this time the diagnosis ought surely to be possible. Even if the mother or nurse does not observe any irregularity, a careful family physician should not overlook such a condition.

The early diagnosis of this congenital disease is of such importance, because the **actual dislocation** of the hip does not take place until the child begins to walk, and exerts pressure on the joint by the weight of the body.

The symptoms are so different in unilateral and bilateral dislocation, that I describe them separately.

The **principal symptom** in unilateral dislocation is **shortening** of the affected limb, producing limping. The limb is shortened without any pressure on it, but as soon as the weight of the body is thrown on it, the

Unilateral dislocation.

shortening becomes still more marked. The entire side of the body gives, and leans over toward the affected side. At the same time the **pelvis is rotated** on its perpendicular axis, so that the iliac spine of the sound side is turned forward. If the shortening is very pronounced, the patient holds his **foot in equinus position** to make up for the shortening. If the patients stand on the entire sole of the affected foot, they have to bend the knee of the sound side considerably. If the head of the femur has wandered high up and far back, the affected limb is held in slight abduction and flexion. The spine shows a marked scoliotic posture, with a convexity to the affected side.

If the patient is placed in the **horizontal position,** we can **measure the shortening.** The pelvis is to be absolutely horizontal, the two iliac spines must be at an equal height. The limbs are then put in symmetrical position (straight), and we measure the distance from the anterior superior iliac spine to the internal malleolus. This shows at once the shortening. How high the trochanter stands, can be measured either by indicating the two trochanters with the finger-tips, and comparing the two sides, or by measuring the **Roser-Nélaton line.** The limb is half flexed and we mark with the finger-tips the anterior superior iliac spine and the tuber ossis ischii, and lay a ribbon or tape-measure along the line connecting these two points. Normally the trochanter ought to lie in this line.

Palpation finally shows the dislocation directly. If we take hold of the thigh at the knee, flexing the leg, and rotate slightly forward and outward, we can easily feel the motion of the **head above its normal place,** and sometimes we can push the head of the femur still higher. At the same time we can feel, at the base of Scarpa's triangle, the empty socket.

If we look at a patient with bilateral dislocation of the hip, while standing, we see the following:

Bilateral dislocation.

The patient appears unusually short in stature; the trunk seems normally developed, but the legs are too short. The arms hang down in monkey fashion to the knee, the pelvis appears wedged between the thighs, spreading them apart and bringing the knees together. There is a very **marked lordosis,** forming a sharp angle; frequently the heads of the femurs can be seen under the skin. If the case is very pronounced, the patients bend their knees in standing, to maintain their equilibrium. The gait is very **characteristic,** and is usually compared to that of a duck. If the case becomes very pronounced, the trunk moves from side to side like a pendulum, as the patient walks.

If the patients lie down, palpation and measurement show the same relative conditions as in unilateral dislocation, only we cannot find a shortening of either limb, except when the affection is not equally pronounced on both sides. Flexion, extension, and abduction are hindered. The limbs can be pulled down (lengthened, so to speak) only if the capsule is extremely loose. All the muscles of the lower extremity are atrophied to a marked degree.

As soon as the diagnosis of congenital dislocation, unilateral or bilateral, is made, energetic treatment should be recommended, either bloodless reposition according to Schede, or bloody reposition by operation.

Differential diagnosis.

Differential diagnosis has to take into consideration **rhachitis** (rickets). The only similarity between the two affections is the **manner of walking.** The displacement of the head can be easily proven by the above-named method and decides the question.

Coxa vara might be mistaken for a congenital dislocation. They have in common only the high position of the **trochanter,** but in coxa vara the head can easily be felt in its normal place.

Paralytic dislocation.

Paralytic dislocation shows very little similarity to congenital dislocation. In the former, the head is usually **dislocated forward** on the os pubis, while in the latter the dislocation is backward; in congenital dislocation the muscles are atrophied, as mentioned above, but not **paralyzed,** as in the paralytic dislocation. Besides this, in the latter we can move the limb in almost any direction, while in congenital dislocation the head is more fixed. The **anamnesis** also is entirely different. Children with congenital dislocation begin to walk late, as said above; in paralytic dislocation the children develop normally, begin to walk at the right time, and walk normally. Suddenly they have an illness, with **high temperature,** after which the disturbances in walking and standing are observed.

X-ray pictures decide all these questions definitely in an unmistakable manner.

INJURIES OF THE HIP.

Dislocation of the Hip.

Dislocation of the hip is **rare,** owing to the great resistance of the capsule.

The anamnesis usually reveals the mechanism of the dislocation. We learn that the normal limits of motion in the joint have been ex-

ceeded through the action of some great force, either a fall from a considerable height, or the wheels of a truck passing over the hip, or a heavy weight falling on the patient.

The dislocation is possible,

1st. Backward.

2d. Forward.

3d. Upward.

4th. Downward.

Dislocation backward.

By far the most frequent dislocations are those **backward,** resulting in either the **iliac dislocation** or the **sciatic dislocation.** The difference between the two injuries is comparatively slight, as the sciatic is really only an exacerbation of the iliac. In both the **symptoms** are very pronounced and unmistakable. The dislocated limb is **flexed, adducted, and rotated inward,** and appears shortened. The **shortening is double—an apparent shortening,** as the patient tries to relieve the adduction by raising the pelvis on the injured side, **and a true shortening,** through the dislocation of the head from the socket upward, proved by measuring the Roser-Nélaton line. The pelvis appears broadened in its frontal diameter on the injured side, the buttock fuller. Under the glutæi the dislodged **head can be felt** as a hard, spherical body, especially if we try to rotate the thigh. The limb is fixed in its pathological position. Active motion is suspended, passive abduction and outward rotation also. The resistance to passive motions is resilient.

Dislocation forward.

Dislocations forward. They may be either suprapubic or infrapubic. The mechanism of the **suprapubic dislocation** is a forcible bending backward of the trunk; the **limb is extended, abducted, and rotated outward.** There is a measurable shortening of the limb, as the head lies above the socket; but apparently the limb may be lengthened, owing to its position in abduction: Below Poupart's ligament we can see and feel a spherical prominence, which proves on rotation to be the head. The femoral artery pulsates on the mesial side of the head, or lies sometimes on top of it. Active motion is completely suspended, passive motion is possible only in the sense of abduction and rotation outward.

Infrapubic dislocation is brought about by abduction and rotation outward, as, for instance, if a rider falls off his horse and is caught with his foot in the stirrup. There are **slight flexion and abduction,** with a shortening of the limb. This deformity can best be seen if the patient is laid on his back. The buttock appears flat, the normal prominence of the trochanter is absent, and the thigh appears broadened at its proximal

IMPACTED INTRACAPSULAR FRACTURE OF NECK OF FEMUR.
(Fractura colli femoris subcapitalis.)

end. The **limb is fixed** in a dislocated position. All motions, except slight abduction and flexion, are suspended. Sometimes the patients are able to walk when the injury is recent, but pressure on the nerve usually produces pain and frequently numbness.

Dislocations downward and upward are very rare. In the former case, the thigh is flexed to ninety degrees toward the pelvis. Extension is impossible. In the latter case, the extremity is extended, adducted, and markedly rotated outward; it is shortened and the head can be felt directly beneath the anterior superior spine.

Dislocations downward and upward.

In rare cases **both hips** become dislocated, the symptoms being the same as in unilateral luxation. As one does not usually expect a double dislocation, one might overlook one side for the time being.

Voluntary dislocation of the hip-joint has been observed comparatively frequently. Some cases are known where the patients, if they can be called so, show themselves as freaks who can dislocate nearly all their large joints.

Fractures of the Proximal End of the Femur.

The different fractures of the upper end of the femur have lately been studied very exactly, and their classification has been accepted more or less generally, as follows:

Supratrochanteric fractures, to which belong the **fractura colli femoris superior,** also called **subcapitalis,** and **fractura colli femoris intertrochanterica.** To the other group belong the **fracturæ infratrochantericæ** which are divided into the **pertrochanteric** fracture and **subtrochanteric** fracture. Under certain conditions two of these typical fractures are combined, thus forming Y fractures. Finally **isolated fracture** of the **trochanter** occurs, though very rarely.

It is extremely unlikely that the general practitioner, with the comparatively small practical experience he can gather, should be in a position to make the differential diagnosis between all these forms. But in any case it is a question whether there is any practical value connected with this dogmatic differentiation.

Exact differentiation not necessary.

We should also give up the attempt to differentiate between intra-articular and extra-articular fractures, because this differentiation is impossible.

For practical purposes, it is sufficient to recognize a **fracture of the neck** of the femur, and to find out if the fracture is **impacted or not.** Except in very fat persons, the *x*-ray picture will clearly indicate the

nature of the injury. The fracture occurs practically only in elderly or aged people, after fifty.

The etiology usually shows that in aged persons the fracture is due to a comparatively slight force, as a fall by slipping on the level ground, or a fall from a chair, sometimes even by muscular action.

Fracture of the neck of the femur.

Another mechanism is parallel to that of the dislocation of the hip backward. In the aged the iliofemoral ligament may tear off the neck of the femur, if the patient tries to recover himself when slipping, by throwing the trunk backward.

At the moment of the injury, the patient feels a **sharp pain,** which afterward is comparatively slight as long as he does not move, but is increased on active and passive motions, especially in the sense of flexion and extension. If the fracture is not impacted, the limb is generally entirely useless. At least the patients cannot raise the lower extremity with outstretched knee. If the fracture is impacted, the patients can frequently not only move the limb, but sometimes even walk.

Symptoms.

Inspection shows a large **swelling and broadening** of the affected hip, the inguinal fold is smoothed out and shortened. Below and to the outer side of the iliac spine, we notice a hemispherical prominence. The entire **limb is rotated outward,** whether the fracture is impacted or not. Only in extremely rare cases a rotation inward takes place. The broken limb is **shortened,** if impacted, about an inch; if free, it may be much more.

A very **characteristic symptom** of the fracture of the neck of the femur is that the usually resilient **tension of the muscles,** which in general connect the crista ossis ilii with the trochanter and the femur, **is lost.** We test this tension by palpating it anteriorly, and find that the tensores fasciæ latæ in the glutæi are loose. The mechanical explanation is perfectly clear, as the points of origin and insertion of these muscles are brought nearer together. In short, the buttock, examined just above the trochanter, is soft.

Palpation and rotation, to detect crepitation, must be done with **extreme care,** until we know whether the fracture is impacted or not. As the former is decidedly to the advantage of the patient, it would be a great mistake to loosen the impaction by overzealous examination. The same holds true for examination for abnormal mobility.

Differential diagnosis.

Differential diagnosis has to consider dislocation of the thigh forward, and possibly fracture of the pelvis of the affected side, and simple contu-

sion of the hip-joint. Before the use of the *x*-rays this latter differentiation was sometimes quite difficult.

Isolated fracture of the trochanter is extremely rare. The only symptom besides light flexion and forward rotation of the limb is crepitation, elicited at times by rotary movements of the limb. The skiagram will show the otherwise difficult diagnosis.

DISEASES OF THE HIP-JOINT.

All acute infectious diseases may make **metastases** in the hip-joint. Scarlet fever, measles, diphtheria, small-pox, pneumonia, typhoid fever, and gonorrhœa may infect with their specific bacteria either the capsule or the bone. All these infections have a tendency to **lead to suppuration** of the joint, as the infection usually becomes mixed with that of staphylococcus or streptococcus.

Differential diagnosis important.

The **differential diagnosis from rheumatic affections,** where palliative and expectant treatment is justified, is therefore of great importance, as the acute infectious diseases of the hip-joint very frequently necessitate early surgical treatment.

The most common etiological factors are **typhoid fever, gonorrhœa,** and **osteomyelitis.** In all three, but especially in the latter, the attack is very sudden, and sets in with **high temperature and chill.** Extreme painfulness is experienced at once, and the entire **clinical picture is much more grave** than in a rheumatic affection of the joint. Besides this, rheumatism usually affects a number of joints, which other infectious diseases do not, except in very rare cases. One has to know, however, that **osteomyelitis** especially may affect several joints, though not equally severely.

In very serious cases, if the patient does not succumb, the disease quickly leads to **destruction of the bone,** so that **spontaneous dislocations** backward and upward may result. This is usually not the case until the later stages of the disease, and sometimes not until the patient gets on his feet.

Tuberculous Hip Disease.

It is decidedly a disease of youth. The age of the patient varies from two to eighteen, although I have operated on a number of cases of tuberculosis in persons as old as forty years. It may be said in advance that

in all tuberculous affections the **prognosis** becomes decidedly more infaust with increasing age.

Anamnesis usually shows trauma as an etiological factor.

The injury may be only slight at the time, and apparently of no consequence, when, two or three weeks later, the **first symptom** of the beginning hip disease occurs; this is **pain,** which produces another very important sign, **voluntary limping.**

On which leg does a person limp?

I find that a great many persons and even physicians do not recognize **on which side a person limps.** In walking, the patient rests the weight on the affected limb only a very short while, and advances the sound leg very quickly to support the body and take the weight from the painful, affected side.

The **pain** is not only the first, but also **one of the most important symptoms.** A curious fact is, that in most cases the pain in unmistakable hip disease is **referred to the knee-joint,** especially the hollow of the knee. Very frequently patients do not complain of pain in the hip, but only that the pain is in the knee, so that a mistake in locating the disease is very frequent. It should therefore be remembered that **pain in the hollow of the knee is pathognomonic for hip disease.**

As long as the affection is purely interosseous and the joint therefore not infected, the diagnosis presents some difficulties, which the skiagram sometimes helps to solve.

Three typical tender spots.

As soon as the **joint becomes infected,** there are **three typical points** tender on pressure. The first is found by pressure on the **head** of the femur from in front, just below Poupart's ligament and to the side of the large vessels; the second point is directly **behind the trochanter,** and the third, and quite important one, is where the **adductor muscles** are attached to the os pubis.

Even if the joint has not yet been infected, *i.e.*, if the infection is purely an osseous affair in the head of the femur, if only **pain in the knee** is present and **inability to bear the weight** of the body on the affected hip-joint, without any pathological positions or contractions of the joint, the **diagnosis, tuberculous hip disease,** should at least be taken into consideration.

Early diagnosis very important.

The time has gone by when we wait for crepitation in the joint to show us that the head has been destroyed. It must be our endeavor to make the diagnosis as early as possible.

With the increase of tuberculosis in this country, especially by the influx of poor foreigners, tuberculosis of the bones and joints is decidedly

more frequent. The enemy of an exact diagnosis of a joint affection is the all-embracing "rheumatism."

Early diagnosis is not only important in order to give the usual treatment with Buck's **extension** or an extension-splint, but because early operations, eventually exploratory trephining, with the removal of only the small affected area, will doubtless be the surgical treatment of this disease in the future. At present there is too much and too long continued orthopedic treatment.

The pain is, in another respect, very important. If it is felt in the hip-joint itself and continuously in the same small circumscribed spot, it indicates a **localization** of the tuberculous infection, so that we can rely on finding a focus at the designated place. A Roentgen picture in a number of cases, especially in small children, will reveal the affected spot.

The **further course** of the disease is rather slow; acute exacerbations recur from time to time, usually with high fever. Small children, even if temporarily free from severe pain, will suddenly wake up at night with a cry. If the child is observed at this time, clonic muscular spasms can frequently be seen. After a short while, the child falls asleep again. These shooting, sudden, violent attacks of pain, especially at night, are characteristic of any bone disease.

Pain at night characteristic.

The next important symptom, **swelling of the joint** and its surroundings, is not so pronounced in hip disease as in other tuberculous joint affections. If the joint is filled with serum, seropurulent or thicker material, fluctuation may be felt by an experienced examiner. To **prove effusion** into the joint, an **exploratory puncture** can be made. The needle is to be inserted just above the (highest) proximal point of the trochanter and pushed in a frontal direction, when it will strike the junction of the neck and head. If we then scrape it along in an upward motion we shall enter the joint.

The **functional disorder of the joint** appears very early. The ability to move the joint is gradually lost, until complete fixation ensues. At the same time atrophy of the entire limb can be observed.

Function impaired.

Very important are the **pathological positions of the joint and the contractions of the muscles.** If we call the stage of pain and limping the first, the second stage is when deformity of the joint develops. Usually the limb is held in flexion, abduction, and outward rotation, a position which changes later on to flexion, adduction, and inward rotation (third stage). The latter position may be assumed at once. If we look at the drawings of Figure 1, Introductory Chapter, page 6, we see how

abduction produces apparent lengthening of the limb, and adduction apparent shortening.

The **abnormal position of the pelvis** and the thigh produces, after a while, a pronounced lordosis and scoliosis. The latter presents its lumbar convexity toward the lower side of the pelvis, and the compensatory dorsal convexity toward the elevated side of the pelvis.

Dislocation in later stages.

In some cases **subluxations and luxations** occur in the later stages; either a displacement develops slowly or the dislocation occurs suddenly, if after a preparatory loosening of the capsule the joint receives a slight injury. A symptom somewhat similar to this is the so-called **wandering of the acetabulum,** *i.e.*, the upper edge and wall of the acetabulum are worn away by the constant pressure of the head of the femur, so that the latter is free to leave its socket. The femur either becomes fixed in this new position, or it may be pulled down to its original place, if the shrinking of the affected tissue is not too pronounced.

To examine for crepitation.

Crepitation can be felt, if the cartilage of the articular surfaces is destroyed before the joint becomes entirely fixed. Very soft crepitation may be produced by tuberculous granulations of the capsule. To examine for crepitation, it is well to use chloroform **narcosis,** first to avoid unnecessary pain, and second, to exclude voluntary contractions of the muscles. As the bones undergo fatty degeneration, the crepitation is much softer than usual. Frequently we do not get crepitation except on rotation with abducted thigh. Very frequently, after such an examination under narcosis, the little patients have a high temperature, up to 104°, for a couple of days.

As long as the process is confined to the bone and the joint is not yet affected, there need not be any fever, if the patients do not have a tuberculous affection of any other organ.

Effusion in the joint produces fever.

As soon as there is a serous or seropurulent **effusion** into the joint, we observe a fever curve of remitting character, the evening temperature reaching as high as 101.5° and the morning temperature being normal or even subnormal if the patients have been considerably run down. If the variation is two degrees or more, we have to consider the upper limit fever, even if the range is as low as between 97.5° and 95.5°. Sometimes the patients are entirely free from fever for a number of days, and then have again a slight rise of temperature continuing for a long period. In severe cases we sometimes observe continuous high fever, especially at the time when **abscesses** are forming; after this process is completed, the temperature frequently goes down.

Differential diagnosis has come to consider a number of affections with which tuberculous coxitis may be confounded. First we have to consider **all other forms of inflammation** of the hip-joint, as rheumatism, gonorrhœa, syphilis, hip-joint disease **as a metastasis** of systemic infectious diseases and osteomyelitis; **congenital or acquired deformities,** as coxa vara, **retarded growth** of the bone after infantile paralysis and congenital dislocation; **injuries to the joint,** as fracture of the neck of the femur, traumatic separation of the epiphysis, and, lastly, **purely symptomatic pain** without any anatomical basis, as growing pains, hysteria, and neuralgia. Differential diagnosis.

The differentiation of **osteomyelitis and tuberculosis** is very frequently impossible, although osteomyelitis usually takes a more acute course than tuberculosis does; but the differentiation is really not of such great practical importance, as they both demand the same treatment and need the same operation. Osteomyelitis.

Syphilis and gonorrhœa may be proved from the anamnestic data, and other signs, that these diseases have been acquired.

If any other general infectious disease has been the forerunner of coxitis, it is usually well known to the patient and his family.

Rheumatism (polyarthritis) is, as well known, rarely monarticular, and does not attack the hip-joint very frequently. A diagnosis of rheumatism is permissible only after all other possible diseases have been carefully excluded.

If we find by measurement a shortening of the neck of the femur, we have to consider as possible **coxa vara,** a condition characterized by abduction and rotation outward. The hip-joint is usually in extension, but in exceptional cases may be in flexion. Abduction is not painful, but is limited, as is also inward rotation. A skiagram will clearly reveal the true conditions. Coxa vara.

If the so-called "wandering of the acetabulum" has taken place, we may have to consider **congenital dislocation.** In the latter affection, all motions are painless and free, in contrast to the condition in coxitis.

Traumatic injuries to the neck of the femur are of importance, as most cases of coxitis start after some (slight) trauma. Usually the anamnestic point, whether the trauma was slight or not, decides the question. Skiagram!

Neuralgic or **growing pains** may be hard to differentiate from the pain of the prodromal stage of coxitis. Neuralgic contractions also pro- Neuralgia.

duce flexion and forward rotation, but examination under an anæsthetic and skiagraphy ought to make the diagnosis clear.

Hysteria.

In surgical diseases I always consider the diagnosis, hysteria, a *testimonium paupertatis* for the physician. Only in cases where a perfectly plain and well developed clinical picture of hysteria, with all its symptoms is before us, is such a diagnosis permissible, and even then we have to consider that a person with hysteria may have tuberculosis as well.

Other Inflammations of the Hip-Joint.

Besides the affections of the hip-joint described in the differential diagnosis of tuberculous hip disease, we have to mention arthritis deformans and neuropathic affections of the hip-joint.

Arthritis deformans rarely ever happens in young individuals. If so, it occurs at the age between fifteen and eighteen, but always after a trauma, while the senile form is usually not due to any injury. The course of the disease is ordinarily extremely slow, leading to remarkable, irregular, and sometimes grotesque **deformities of the head and neck** of the femur. The neck may be bent, as in coxa vara, or it may be extremely short, and the head may be either very small and irregular or greatly enlarged. The acetabulum is usually a negative cast of the form of the head. The disease generally attacks persons beyond the fortieth year, and begins with pain; the patients become easily tired and begin to limp. The mobility of the joint is diminished, and after a long course, sometimes of years, palpation shows bony excrescences and irregularities of form. Finally the entire hip-joint bulges out, the limb is in adduction, rotated outward, and shortened, both apparently and truly. The trochanter stands high above Roser-Nélaton's line. There is **no acute inflammation** to be observed, and none which, even in the later stages, ever leads to the formation of pus or abscesses. As the pain radiates along the ischiadic nerve, the disease in its beginning stage is frequently mistaken for sciatica.

Changes due to arthritis deformans.

Differential diagnosis.

For differential diagnosis the **resistance to abduction** is very characteristic. There is no fever. The recognition of the disease is of importance, as a proper orthopedic, not operative, treatment is of great value and prevents further deformation.

Tabes.

Tabes and syringomyelia quite frequently develop an arthropathy of the hip-joint.

In **tabes** the joint affection may occur in such an early stage as to be

practically the **first symptom** that calls our attention to the disease. The affection usually begins suddenly, with acute effusion into the joint. Pain and fever are absent. Frequently the head is rapidly destroyed, and subluxation and dislocation may occur. Grating crepitation is, of course, present as soon as the changes in the head take place.

In **syringomyelia** arthritis develops, usually after a trauma, in an acute form with fever and often chill, but without pain. Acute swelling of the joint sets in. The treatment to be recommended is orthopedic. Syringomyelia.

Coxa vara is, we may say, practically a disease which occurs only during adolescence. To understand the clinical symptoms it is necessary to know the anatomical fact that the transformation in bending the neck of the femur occurs in the following way:

The axis of the neck and the axis of the shaft form an angle toward the mesial line of about 128 degrees under normal conditions. In well-developed cases of coxa vara, this angle is reduced to sixty degrees. If we compare the normal femur and that in coxa vara, it looks as if the entire **neck with the head had been bent** downward, an impression which corresponds to the mechanism of the deformity. As the head of the femur is fixed in the joint, the trochanter moves upward, so to speak. If these anatomical changes are rightly understood, the diagnosis of the disease loses a great deal of its difficulties. The **skiagram** shows the conditions very plainly. We have only to make sure, in taking the skiagram, that the joint and the tube are in the right relative position. The patient lies on his stomach, the limb in question being rotated inward or at least perfectly straight (the feet project beyond the edge of the table so as not to interfere with the position of the legs); the tube must then be exactly above the neck of the femur. Deformity in coxa vara. Radiogram. How to take it.

The diagnosis may be extremely difficult, if not impossible, even with the help of the Roentgen rays, so long as the deformity is not well developed. Pains are present only at the beginning. If the disease has been recognized in its early stage, which it rarely is, the treatment to be recommended is orthopedic and general, while in the later stages, operative procedures are in order, such as osteotomy or, if necessary, resection of the head. Diagnosis.

Bursitis of the Hip-Joint.

There are three important **bursæ** in the neighborhood of the hip-joint, the **subiliac** bursa, the **trochanterica profunda,** and the **trochanterica superficialis.** Although inflammation of these bursæ, or the for-

Inflammation or hygroma.

mation of a hygroma, is comparatively rare, it is necessary to remember the possible occurrence of this affection in forming a differential diagnosis, especially from hip-joint disease. The swelling of the bursa can ordinarily be felt, so that **palpation** really **decides the diagnosis.**

Careful examination usually reveals **fluctuation,** which cannot be felt if the wall is too thick or the tension of the overlying muscles too great; the latter can be overcome if we put the limb in forced flexion. The tumor is smooth and usually somewhat movable.

Position of leg.

The **principal symptoms** are swelling and pain. To avoid the latter, the patient commonly holds the limb in a certain fixed position, usually flexed and in abduction and rotation outward. In narcosis the movements, which were hindered before, are free. The trochanter, of course, stands at its normal height.

If pus has formed, wide incision or extirpation has to be recommended.

INJURIES AND DISEASES OF THE THIGH.

INJURIES OF THE SOFT PARTS.

Injuries of the large vessels in the inguinal region are quite frequent, owing to their exposed position. All forms of injuries, such as cuts, stab wounds, tears, gunshot wounds, may occur. Either the **artery** alone may be injured, or the **vein,** or both together; or the **nerve** separately, or together with the vessels.

If the wound in the **artery** is small, the blood may flow instead of spurting, but is of bright red color. If the vessel is severed completely, the blood spurts typically. Injury of vessels.

Injury of the **vein** is characterized by the slow and steady flow of dark blood.

Injuries of the **nerves** produce the clinical symptoms of paralysis.

Injuries of the **muscles** may occur in any form, and are easily recognized as such. Of special interest is the **tear of the adductors** in horsemen. If the muscles are partly torn, a diastasis can rarely be felt, but a hæmatoma forms which can be seen and palpated. It is tender on pressure. Injury of muscles.

A typical injury is the **rupture of the quadriceps,** which may be produced if a person tries to recover himself when slipping or falling. Not only are the muscles contracted forcibly, but at the same time the trunk is thrown backward. If the tear is more or less complete, a true diastasis can be felt. But the patients are not completely disabled, and are usually able to walk, except where the other extensors, the external and internal vastus, are also torn; then the patella cannot be held tense, and does not follow the contraction of the muscle, but hangs loose.

Of the **inflammations of the muscles,** I may mention the so-called rider's bone, a long, thin bone formed in the fibres of the adductors.

Sciatica.

Neuritis of the sciatic nerve is quite frequent; it usually affects adults.

The **principal symptom is pain.** The onset may be severe, with

moderate fever, but as a rule it is gradual, and for a time there is only slight pain in the back of the thigh, especially in certain positions or after exertion. Soon the pain becomes more intense and extends down the thigh, reaching the foot.

Sensitive spots.

There are **three spots** which are usually sensitive. One at the notch, the other in the middle of the thigh, and the third in the hollow of the knee, just under the capitulum tibiæ.

In **diagnosis** we have to search for etiological factors, especially for tumors which might exert some pressure on the nerve. Examination of the rectum should therefore always be made, and in women a vaginal examination as well.

Differentiation.

As in many cases the **roots of the lumbar nerves are tender** on pressure, the affection is sometimes mistaken for lumbago.

As the patients bend their knees and tread on the toes to reduce pain during walking, the neuritis may be mistaken for hip-joint disease. **Tenderness on pressure along the nerve** is characteristic.

Sacro-iliac disease must also be excluded. The severe pains connected with tabes differ enough in their character to insure the diagnosis.

Fractures of the Femur.

The femur may be broken by direct or indirect force. Direct force must be strong to produce a fracture of the thigh; this is usually the result of a heavy weight falling on the patient, or of the wheels of a heavy truck going over him, especially if the thigh does not lie flat on the ground. **Fracture by direct force** may occur wherever the force is applied, but usually happens toward the lower end of the bone. Frequently it is combined with serious contusions of the muscles, with blood extravasation, etc.

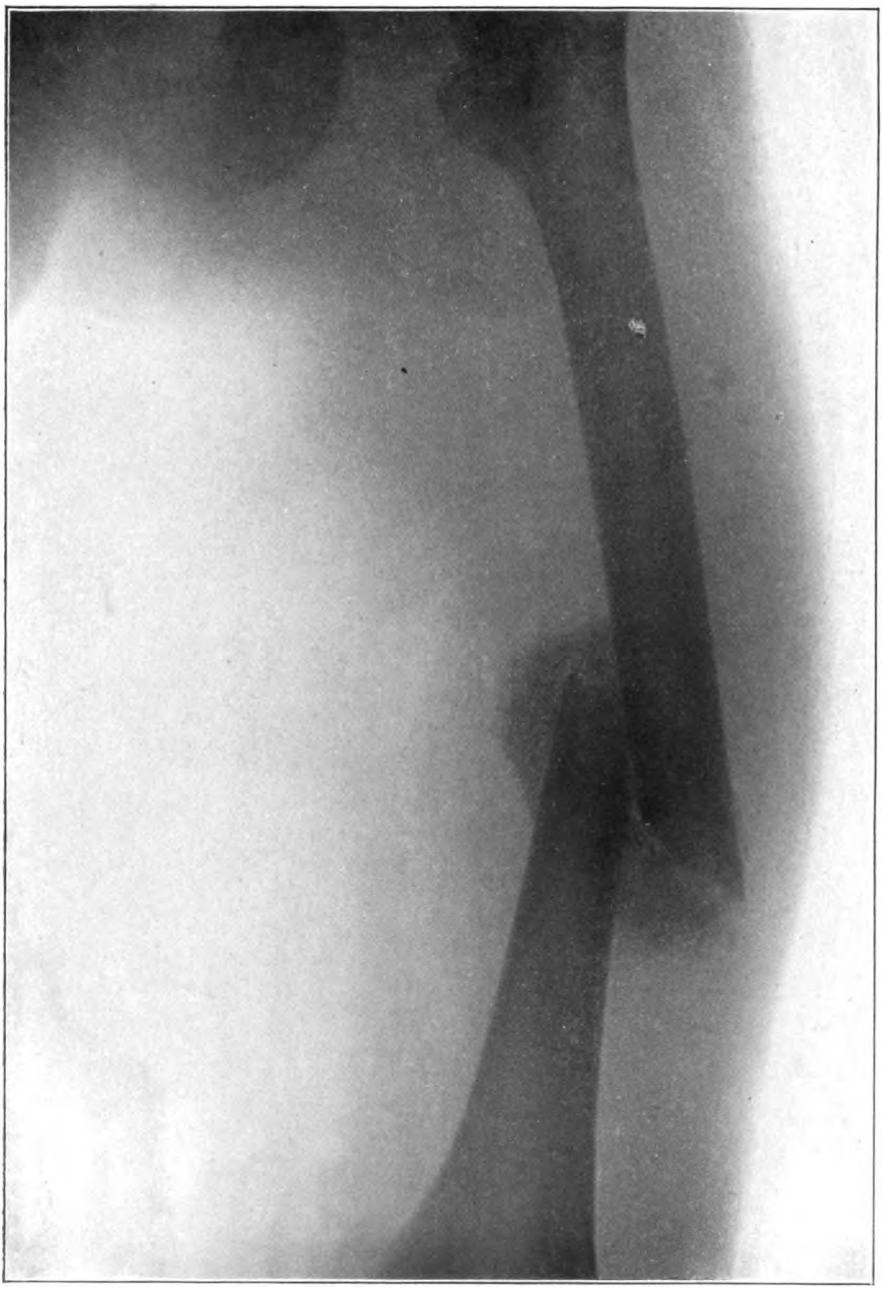
The **indirect fracture** is caused by a fall on the feet, by a violent twist of the thigh, or by a twist of the body. The **line of fracture is very important** as regards both diagnosis and treatment.

Direction of fracture important.

Transverse fractures are usually the result of direct force, when the line is smooth; they are produced by indirect force as a rule only in rhachitic persons, when the line of fracture is usually serrated.

Oblique fractures are the typical form of fractures by indirect force. Frequently the line of fracture runs parallel to the axis of the bone, in some cases through its entire length.

Spiral fractures produced by torsion are much more frequent than



FRACTURE OF DIAPHYSIS OF FEMUR.
Fragments overriding. Note callus.

was formerly assumed, as we have been taught by skiagraphic experience.

Frequently a triangular or lozenge-shaped splinter breaks out separately.

Fractures of the diaphysis of the femur are so characteristic that the injury can usually be recognized at once. The limb appears rotated completely outward. The anterior surface of the patella is turned so as to face laterally. The limb is shortened, either slightly, or to as much as six inches. The latter happens if the fragments override each other. The measurement is best taken from the anterior superior spine down to the malleolous internus, after the pelvis has been straightened, so that the line connecting the two spinæ intersects the mesial line at right angles. Another simple way of measuring is to fix the pelvis straight, with the limbs parallel to the mesial axis in a position between adduction and abduction, and then press a board against the sole of the sound foot. The shortening of the injured limb then shows very plainly, and its amount can be measured. Fractures of the shaft. To measure shortening of the leg.

Very frequently there is a **pronounced deformity,** marked by angular displacement, with one apex looking outward. If the deformity is not very pronounced, it may be concealed by the swelling. Sometimes the end of the fragments can be felt or seen, right under the skin, or in compound fractures perforating the same. Other symptoms.

The other symptoms are those common to all fractures, **pain and impaired function.** Crepitation cannot always be felt, as it depends on the position of the fragments, which frequently cannot be moved without narcosis in patients with strong muscles.

DISEASES OF THE BONE.

The most important of the **inflammations** of the femur is osteomyelitis, which occurs during the period of growth, from eight to seventeen. Girls are more subject to it than boys.

The **symptoms** are those of an **acute infectious disease** and serious septic infection, initiated by a chill. The temperature goes up to 104° and more; very violent pain and local swelling characterize the picture. Frequently the patients are somnolent, and are unable to give exact information. In some cases a recent trauma is made responsible for the disease. The affection may be mistaken for typhoid fever in its early stages, before the local symptoms have sufficiently developed. Osteomyelitis.

In very **acute cases** the affection soon, within two or three weeks, **leads to perforation,** forming a fistula.

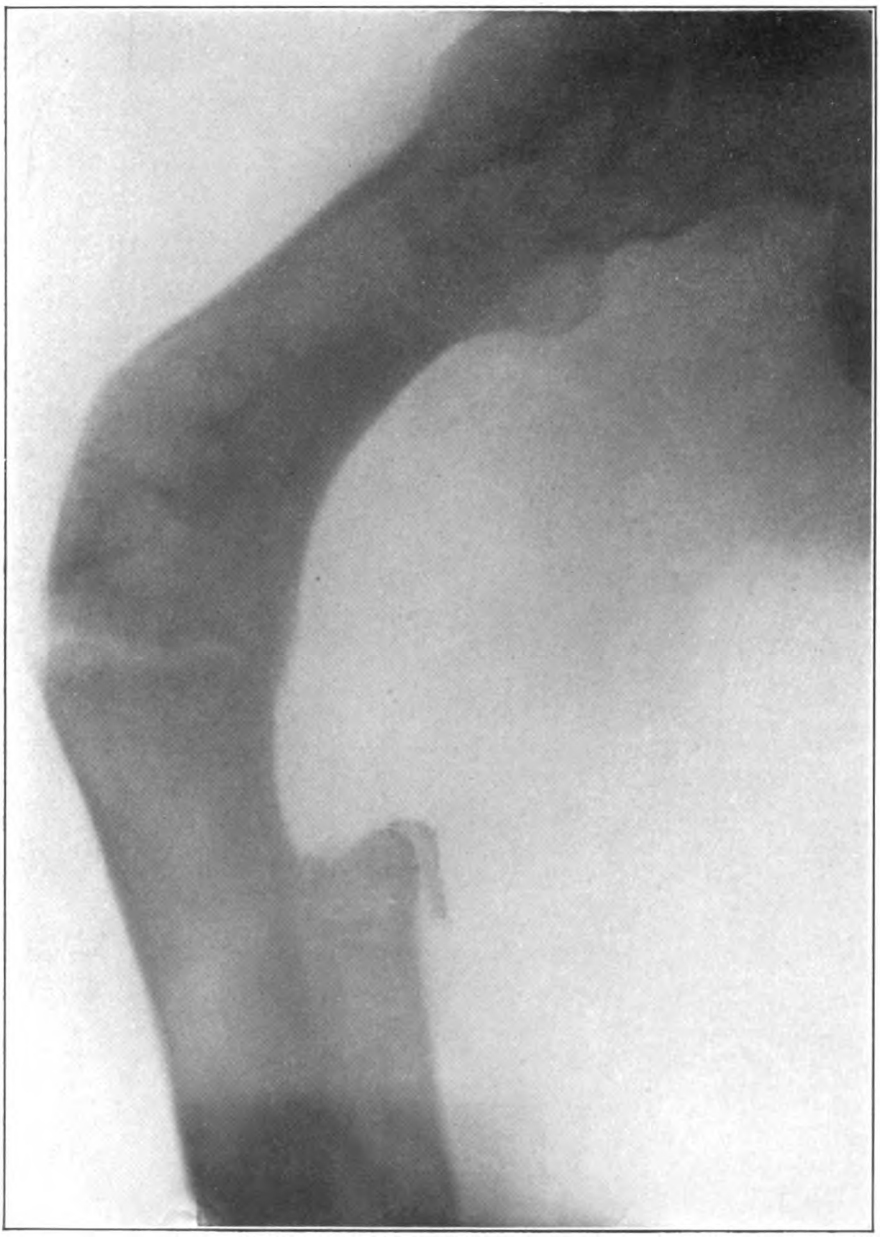
Later course. I mention the further course, **formation of sequestrums,** which become loose after from two to four months, according to their size, because we have to recognize the disease in its different stages. Until perforation takes place, the **pains are very severe,** a fact which we can easily understand when we see the pus welling out sometimes as from a fountain, when the pressure is relieved by exploratory drilling. The pain is spontaneous and irregular; it is very violent, even during absolute rest at night.

If the disease has not attacked the bone in its entirety, the **form of the swelling is characteristic,** as it stops abruptly a little beyond the region of the affected bone.

Length of time necessary to form a sequestrum. Formerly it appeared to be of great importance to determine the exact time when a necrotomy would be indicated. Experience shows that **large sequestra take about three months** and more to form, until the sequestration is complete, the bone dead, and the involucrum (new-formed bone surrounding the old, dead bone) strong enough to permit the removal of the old bone without fracture. It used to be assumed that a sequestrum was loose, if the granulations of the involucrum bled easily. Then the inserted sound could easily move the sequestrum, unless the latter happened to be caught by its sharp points. The sound of dead bone is characteristic (*bruit de pot fêlé*). All these questions are now more or less accurately determined by the skiagram.

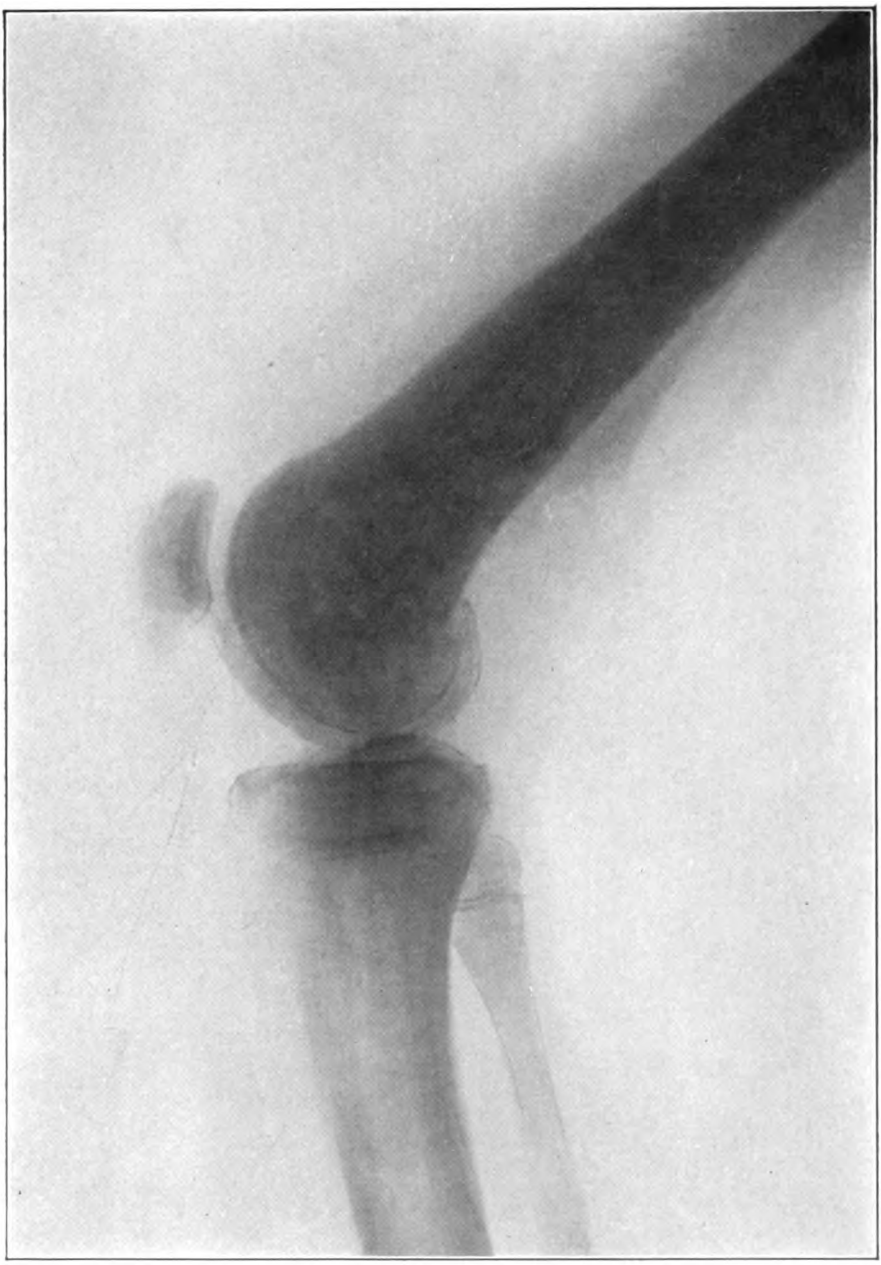
Operation. In modern surgery immediate extensive **operation is to be advised** as soon as the diagnosis of osteomyelitis can be made. If this is done, the infection can usually be checked, so that all the diagnostic questions above alluded to, and that of when to operate in the later course of the disease, can come up only in neglected cases. If this course is followed the **prognosis is decidedly better,** since we prevent amyloid degeneration of the internal organs, and only those cases will be hopeless which succumb to the first violent onset of the disease.

Deformities. If the disease is permitted to run for a long while, all sorts of **deformations** may result—the neck of the femur may be bent in a form similar to that in coxa vara, the shaft of the bone may show enormous thickening with many holes in it, and the distal epiphyseal end may undergo plantar flexion, imitating a subluxation of the knee.



CYSTIC CHONDROFIBROMA OF FEMUR.

Spontaneous fracture. See description under Tumors of Femur.



EXOSTOSIS OF LOWER THIRD OF FEMUR.

Of angular form, situated on the posterior surface of the bone.

LARGE EXOSTOSIS OF FEMUR.

Principally on anterior surface. On top of the growth a large bursa was found.

Tumors of the Thigh.

Tumors of the thigh may start from the soft parts, especially the muscles and fascia, the nerves, or the bone.

Sarcoma.

Sarcoma is by far the most frequent form of tumor. It usually starts from the fascia, and has a predilection for the adductors and flexors, while the extensors are only rarely attacked. In the beginning these tumors are not very hard and the palpating hands feel the growth to be enclosed entirely in the group of muscles which are attacked. If the muscles are relaxed, the tumor appears movable.

Tumors of the nerves.

Neurofibromas and neurofibrosarcomas occur not very rarely. These tumors follow closely the course of the nerve, and are usually quite **painful on pressure.** They have a tendency to begin to grow suddenly, after having been stationary for a long while. The **nervous symptoms** depend upon whether the tumor starts from the sheath of the nerve, affecting the nerve only by pressure, or from the nerve-fibres proper.

Tumors of the bones.

Tumors of the bone may be of varied character. Simple **exostoses** are not very rare, and mostly occur at the distal epiphyseal line, growing especially toward the hollow of the knee. (See Plate XLVI.) Frequently a **supplementary bursa** is formed over these exostoses. These bony excrescences frequently produce such irritation as to justify the recommendation of their removal.

Cystic chondrofibromas usually start just below the trochanter; the bone becomes inflated, so to speak, thinned, and cystic, leading to a bending of the thigh with the concavity toward the mesial plane and frequently to spontaneous fractures. (See Plate XLV.)

Sarcoma.

Myxomas, fibromas, etc., are rare, while **sarcomas** occur in both the periosteal and myelogenous forms. The latter usually start from the lower epiphysis, the former occur more frequently in the diaphysis. In case the comparatively sudden growth of the tumor and its form should not lead promptly to a diagnosis, **harpooning or exploratory puncture** with a big needle is permissible, to give material for a microscopic diagnosis.

Carcinoma also occurs. The differential diagnosis between sarcoma and carcinoma will usually be impossible before operation.

Echinococcus of the shaft will probably not be recognized as such until it is operated upon.

INJURIES AND DISEASES OF THE KNEE.

CONGENITAL DEFORMITIES OF THE KNEE.

Congenital dislocation of the knee forward (genu recurvatum). This deformity is extremely rare; if present, its signs are so distinct that it is impossible to overlook it. The **tibia is dislocated forward,** the condyles of the femur slipping backward, where they can easily be seen and felt in the hollow of the knee. The axis of the leg forms with the axis of the thigh an obtuse angle open forward (the lower extremity is in overextension). This hyperextension produces, besides the bulky prominence in the hollow of the knee, a number (three or four) of cross-folds of the skin over the patella, between which folds excoriation very frequently takes place. The **patella** is hard to recognize, and sometimes not easy to find, but this must not lead to a hasty diagnosis of congenital absence of the patella. The patients cannot flex the knee actively; passive flexion is usually hindered to a marked degree. Sometimes only the hyperextension can be overcome, the leg being straightened; in other cases flexion to the right angle is possible. If passive flexion has been achieved, and the examiner lets go of the leg, it as once snaps back to its former wrong position.

Symptoms.

Active motion suspended.

Besides this hyperextension we find, in some cases, inward or outward rotation. The deformity may be either unilateral or bilateral.

Congenital Anomalies of the Patella.

Congenital **defect of the patella** is not very rare. Any doubt as to the exactness of the diagnosis can easily be solved by an x-ray photograph. The anomaly is usually **combined** with other defects of the osseous system, especially with congenital dislocation of the hip.

Absence of the patella.

The **functional disorder** due to absence of the patella may vary greatly; sometimes the joint functionates perfectly well, while in other cases lateral motion is possible, which interferes with the normal action.

Congenital dislocation of the patella is rather rare, and is hardly ever

observed during or immediately after birth, usually not coming to observation until the child begins to walk, analogous to the conditions we find in congenital dislocation of the hip. In three instances this deformity has been observed in brothers. The deformity itself may be **incomplete,** where the patella lies in front of the lateral condyle, or **intermittent,** where the dislocation occurs only during flexion, or permanent (**complete** dislocation). With this affection changes take place in the ligamentary, muscular, and bony structures of the knee. The muscles of the hip and thigh become contracted, and interfere decidedly with walking. Dislocation of the patella.

INJURIES OF THE KNEE-JOINT.

Contusions of the knee are exceedingly frequent. According to the force of the fall or blow, the **ensuing hæmatoma** is of smaller or of larger extent. Even if the hæmatoma is formed only in the subcutaneous tissue, especial care has to be exercised not to overlook any wound of the skin, through which infection may take place, thus complicating matters seriously.

Frequently the **prepatellar bursa** becomes the seat of the effusion of blood. If it is not filled too tensely, **fluctuation** can easily be felt. The **hemispherical form** can usually be both seen and felt, unless the contusion of the surrounding tissue is so pronounced as to produce considerable swelling.

Much more serious is **hæmarthros of the knee**—effusion of blood into the joint. It is, of course, possible to diagnose only the effusion, but its character, whether serous or bloody, can usually be only surmised before the joint is opened. **Effusion into the joint shows very characteristic symptoms:** the hollow places on both sides of the patella have disappeared, the form of the latter is no longer recognizable, and the entire knee looks puffed up and greatly swollen. The **principal symptom** of effusion in the joint, whether serous or bloody, is "dancing" of the patella. This phenomenon is produced as follows: the examiner stands on the side of the injured limb; if this is the right limb, the left hand of the examiner is passed along the thigh toward the patella in such a way that the thumb and index finger form a fork against which the broad edge of the patella rests. The other fingers of the left hand compress the joint slightly. Now the right index and middle fingers press the patella downward until one feels, and sometimes hears, a **decided click** produced by the patella knocking against the condyles. As soon Hæmarthros. Dancing of the patella.

as the pressure is relieved, the patella assumes its former position. The feeling of **fluctuation** depends upon the consistency of the extravasated blood, which will vary according to the time which has elapsed since the accident occurred. As the blood, after a while, becomes more coagulated, the consistency of the tumor is more doughy. Frequently one can feel the so-called "**snow-ball**" **crackling,** a sound similar to the crackling of snow, as has been mentioned in other chapters. This phenomenon is produced by the crepitation due to the presence of blood. Flexion of the joint is painful, and, therefore, voluntarily limited; the patients hold the limb in a slightly flexed position.

Hæmarthros combined with other injuries.

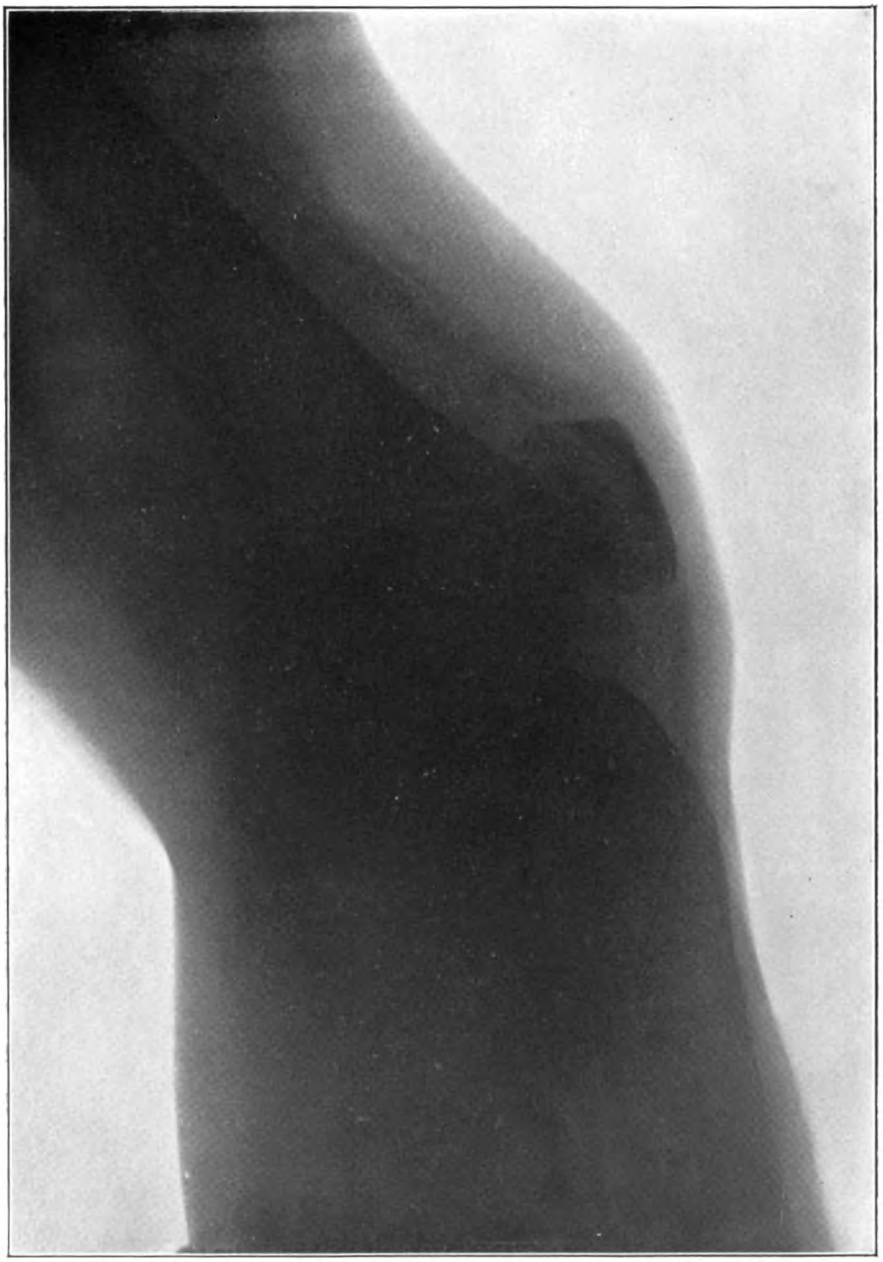
The real difficulty in the diagnosis does not lie in recognizing the hæmarthros, but in not overlooking other injuries which may accompany it; especially the breaking off of small fragments of the articular ends, tearing off, or subluxation, or dislocation of the menisci, or tearing of the lateral or mesial ligament. *X*-ray photographs will be of great help.

The **bloody character of the effusion** can only be determined either by an exploratory puncture, or by evacuation of the joint. The former is really useless, the more so, as the danger of infection of the joint is as great as with evacuation. As soon as the diagnosis of effusion into the joint is made, evacuation ought to be recommended, as the patients are otherwise liable to suffer from a chronic serous exudation and stiffness of the joint of long duration.

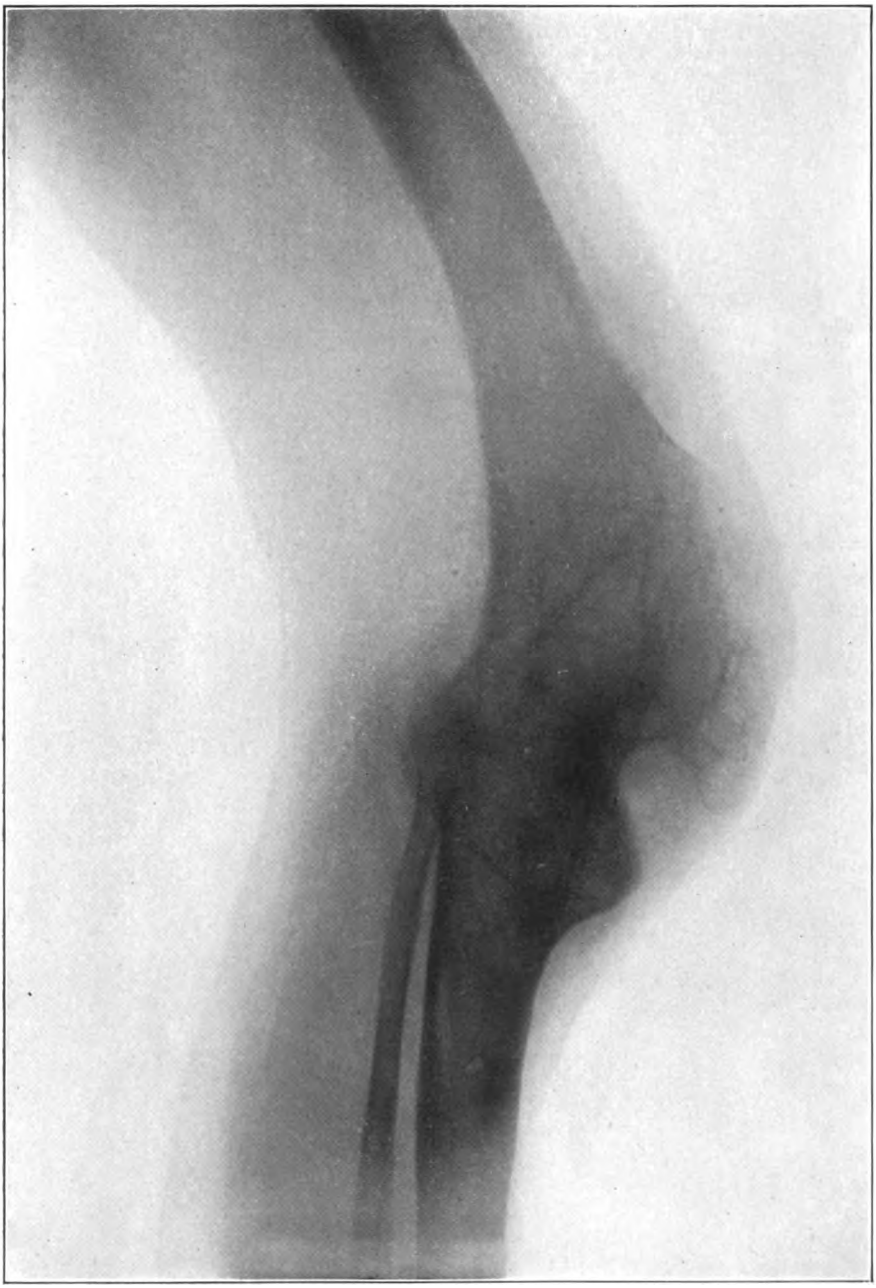
Wounds of the Knee-Joint.

Danger of perforation into the joint.

Wounds in the region of the knee offer no special points of interest or difficulty, unless they **perforate into the joint.** The knee-joint is by far the largest and most complicated joint of the human body, and its infection is rightly dreaded. The decision whether or not a wound at the knee has perforated into the joint, is sometimes not very easy. This is especially difficult in **very small wounds,** such as may be produced by a fall on a tack or nail or a needle, or by the slipping of a sharp instrument, such as the shoemaker's awl, from an object held between the knees. If the knee was bent at the time the accident occurred, the wound of the skin and that of the capsule will not necessarily correspond. I mention this only as an explanation why many such small perforating wounds do not show any later infection, as the knee-joint then practically no longer communicates with the outer air.



OSSEOUS ANKYLOSIS OF KNEE-JOINT
after gonorrhoic infection.



COMPLETE OSSEOUS ANKYLOSIS OF KNEE-JOINT
after septic arthritis.

Probing for diagnostic purposes is absolutely forbidden, except on the operating table under all the necessary precautions.

In **larger wounds** the joint is to be considered open, if cartilage can be seen or if synovial fluid escapes. Usually it is safest to consider any wound, which may possibly be a perforating wound of the joint, as actually such.

Shot wounds are serious injuries if the bones are hit. It is necessary to know that the knee-joint can be perforated by a rifle-ball from in front, without injury to the bone, if the joint is flexed at the time at an angle of from 135° to 170°.

Injury to vessels.

The **popliteal vessels** are injured most frequently in railroad accidents, when a leg is severed, or in fractures of the lower part of the thigh, where the pointed upper fragment may tear the vessels. Usually the **severe hemorrhage** is easily recognized, if it is open or subcutaneous, forming a large hæmatoma. If the popliteal artery is severed, the pulse of the arteria tibialis postica is missing. Comparison with the sound side is advisable.

Fractures of the Condyles of the Femur and Tibia.

Fracture of condyles.

Fractures of the condyles of the femur are very similar to those of the lower end of the humerus. We find the same transverse or diagonal fractures, traumatic separation of the epiphysis, T- and Y-fractures, and solitary fractures of the inner or outer condyle. Fissures also occur. As the latter show only the symptoms of a hæmarthros and violent localized pain on percussion, the diagnosis may be very difficult, except with the aid of *x*-rays.

Deformity.

The same thing may be said of the other fractures, except where the deformity is plain. Usually the **distal fragment** is **displaced backward and upward.** This permits the proximal fragment to enter the hollow of the knee, where it may injure the vessels. **Epiphyseal separation** may be diagnosed in a young individual, if we find abnormal mobility just above the knee-joint, with soft cartilage crepitation. *X*-ray pictures are of great value.

If a single condyle has been broken off, usually by violent direct force, the joint appears broadened, with abnormal mobility, crepitation, and a typical deformity: if the **internal condyle** has been **broken,** we find a **genu varum,** while fracture of the **external condyle** produces **genu valgum.**

Fractures of condyles of tibia.

Fractures of the condyles of the tibia are usually the result of violent direct force, and show still less typical symptoms, as the fracture is frequently impacted. All that can be found is hæmarthros, broadening of the lower part of the joint, crepitation (often lacking), little interference with function, pain, spontaneous and on pressure. A good *x*-ray picture will establish the diagnosis.

Fractures of the Patella.

The patella is a sesamoid bone, inserted into the tendon of the quadriceps. This explains the severe functional disorder produced by fracture of the patella.

Not all fractures of the patella are necessarily accompanied by a hæmarthros, as the lower fourth of the patella is extra-articular. (See Plate L.)

Etiology.

The fracture is caused either by **direct force** or by **muscular tension.** Direct force is responsible in blows or kicks, and in falls when the patella strikes a pointed stone or some similar object.

Fractures by muscular tension occur as a result of **sudden contraction of the quadriceps,** especially with the knee in slight flexion. This

Line of fracture.

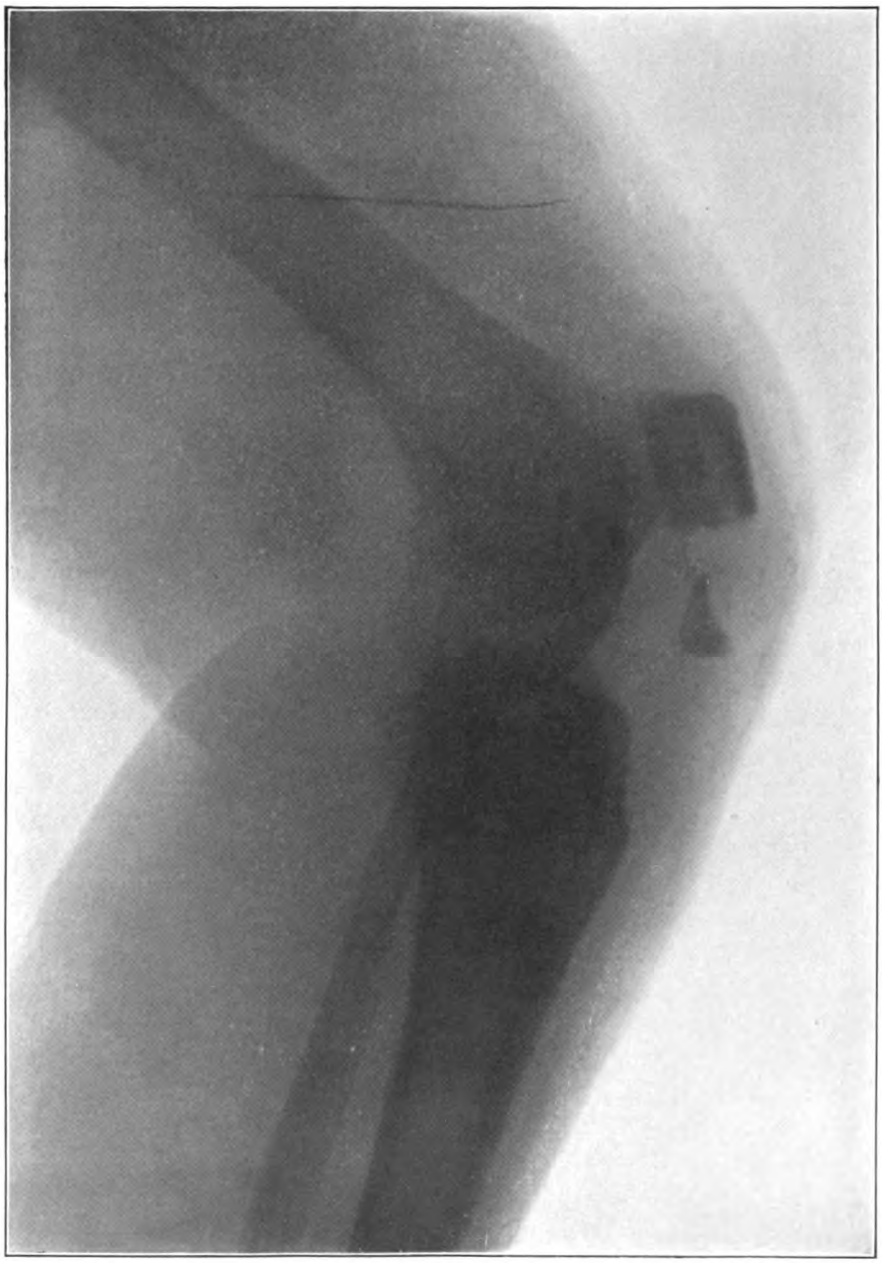
occurs, for instance, when a person stumbles or makes a misstep, and tries to recover himself by straightening up or bending backward. This contraction tears the patella, **usually in a transverse,** more or less straight **line,** while fractures by **direct force** show the so-called **star-shape. Longitudinal** fractures are extremely **rare,** and occur only as the result of **direct force.**

Symptoms.

The **subjective** and **objective symptoms** are both very typical. The patients feel a cracking of the bone at the moment when the fracture takes place. Immediately afterward they fall down, suffer violent pain, and are **unable to use the limb.** Sometimes the patients are able to rise, but unable to walk, or if they do, they really walk with one leg only, hopping on the uninjured and dragging the injured limb. If the patients lie on their back, they are unable to raise the outstretched limb; if they try to raise the heel, they support the leg with both hands.

The **objective** symptoms are quite striking. Inspection shows that the knee is more or less flexed, and the joint appears very much thickened, owing to the effusion of blood. The capsule is distended to the utmost, showing, at the same time, the **indentation where the fragments gape.**

The principal symptom to be seen and felt is the **diastasis of the**



EXTRACAPSULAR FRACTURE OF PATELLA
at distal end. Produced by muscular force.

fragments, which sometimes just admits the finger-nail, while in other cases several fingers can be laid into the gap. The diastasis is increased by active or passive flexion, which ought to be done with great care, as further tearing of the ligamentary apparatus may occur. In cases where the swelling of the joint is very pronounced, the diagnosis of fracture of the patella, with little or no diastasis, may become so difficult as to require the help of the **x-rays.** **Crepitation** can hardly ever be felt. Though it may be very difficult, we ought to try by all means to establish the fact, whether there is interposition of periosteum, as the method of treatment to be applied depends mainly upon that point. *X*-ray pictures, if taken with not too hard a tube, may also show if a torn piece of periosteum partly covers the surface of the fragment.

Diastasis the principal symptom.

Sometimes the **tendon of the quadriceps** or the **anterior ligament** (ligamentum patellæ) tears off, instead of the patella itself breaking. The symptoms are practically the same, and the functional disorders very much alike. If the **anterior ligament tears,** the **patella,** following the contraction of the quadriceps, will be from one-half to two inches **higher** than on the other side.

Rupture of sinew or ligament.

Dislocation of the Patella.

We differentiate dislocation **outward,** complete or incomplete, **vertical** dislocation, and (very rare) **horizontal** dislocation.

Dislocation outward may happen in extension or in flexion. If in **extension** (the more frequent case) the patella is dislocated over the **anterior** surface of the joint above the trochlea. If the dislocatio occurs during **flexion,** the **patella** becomes **wedged** between the external condyle and the head of the tibia.

Dislocation outward.

In **incomplete dislocation** the patella is **fixed** over the **outer edge** of the **trochlea.** **Complete dislocation** of the patella is easily recognized; the patients are usually unable to rise, and all active motion is completely suspended; passive motion is possible only to a limited degree and very painful. The limb is slightly **flexed** at the **hip and knee-joints.** The entire knee-joint appears broadened when seen from the front, the external condyle is very prominent, the intercondylar fossa is empty, and the patella can be felt out of place beside the external condyle. The joint shows more or less pronounced effusion of blood, the result of the tearing of the capsule, without which the dislocation of the patella cannot take place.

Vertical dislocation.

Vertical dislocation is the result of a torsion of the patella to 90° in its longitudinal axis. If the articular surface of the patella, after dislocation, faces toward the mesial plane, we call it an **external** dislocation; if it faces laterally, we call it **inward** dislocation.

The **symptoms** are typical: the **limb** is completely **stretched,** the sagittal diameter of the knee-joint is decidedly increased, the surface of the knee, where normally the patella is situated, is not rounded as usually but hollowed out, and near either the external or internal condyle we find a sharp edge. The **flexion** of the limb is completely **suspended;** passive motion is possible to a slight degree, but very painful.

Horizontal dislocation.

Horizontal dislocation is so **extremely rare** that its description must be left to the hand-books on fractures and dislocations.

Dislocation of the Knee.

The apparatus of the knee being exceedingly strong, dislocations of this joint are quite rare, and are produced only by a considerable force, as a fall from some height, or by some other violent injury.

Dislocations of the tibia.

The **tibia may be dislocated** forward, or backward, or sideways. If the dislocation is complete, the **deformity** is so **striking** as to give the diagnosis at once without the aid of x-ray pictures. It is easy to understand that extensive tearing of the capsular and ligamentary apparatus of the knee-joint must take place to permit of this gross deformity.

Dislocation of the Semilunar Cartilages (Internal Derangement of the Knee-Joint).

Anatomically, **dislocation of the meniscus** is produced by a forced rotation of the leg with the knee-joint in flexion. **Rotation outward** produces **dislocation** of the **inner** (**mesial**) **meniscus.** It is not an over-rare accident in football.

Dislocation of meniscus.

The symptoms are as follows: the patient suddenly feels a sickening pain in the **knee,** which at once **becomes locked** in a certain position; **extension** is **suspended.** This condition may last from a few moments up to several days, when suddenly something gives with a snap, and the free use of the joint is again possible. If this acute stage is followed by a chronic condition, the same phenomenon recurs, on and off, only with less violent pain. Suddenly, for instance in trying to rise, the patient is "caught" in his knee, it is arrested in this position, and he is able to

walk only after a distinctly movable body in the knee-joint has snapped back into its normal position.

Palpation shows at the inner or outer part of the articular gap, according to the character of the dislocation, **a loose body** of cartilage-like consistency, which appears when the leg is extended, and disappears on flexion.

In other cases this free movable body cannot be felt, but the articular gap is very much broadened, deeper than normal, and exceedingly tender on pressure.

Dislocation of the Fibula.

Dislocation in the tibiofibular joint. The fibula may be dislocated either forward or backward. The principal symptom is that produced by **pressure on the peroneal nerve,** namely formication and numbness in the leg. The leg is extended, the foot adducted; if the patient sits, the leg can be moved freely, but he is unable to stand. The dislocated head of the fibula can easily be felt in its abnormal position, while the normal site of the capitulum is empty. Symptoms.

DISEASES OF THE KNEE-JOINT.

Exudation in the Knee-Joint.

Exudation in the knee-joint, or **water on the knee,** may be of traumatic or infectious origin. The effusion is either purely serous, or seropurulent, or purulent. If the effusion is **purely serous,** its **principal symptom** is the **increased bulk** of the joint; there is very little or no pain connected with it, little or no rise of temperature. If the fluid becomes more purulent, the tenderness increases as well as spontaneous pain, and the temperature goes up. The character of the liquid can, of course, only be surmised according to the symptoms, and must be definitely decided by exploratory puncture. Hydrops genu.

The characteristic sign of an exudation of the knee-joint—the "dancing" or ballottement of the patella—has been described above. Of special importance are the metastatic purulent inflammations of the knee-joint following puerperal fever, or other infectious diseases, as erysipelas, typhoid fever, measles, etc. The **gonorrhœal infection** of the knee-joint I also consider a metastatic process. This is much more frequent than has been formerly assumed, and usually occurs within the first weeks of Metastatic purulent inflammations. Gonorrhœa.

the infection. The original disease may have ended; the **exudation forms** rather **suddenly,** and in severe cases is preceded by a chill, followed by high temperature. The **effusion** is usually **purulent** from the start, and the diagnosis cannot be made too early to guarantee prompt evacuation. The **tenderness of the joint** is very marked, and the pain so violent that the patients can hardly be controlled. This tenderness may persist for a long while after the affection of the knee-joint has passed by. There is no question that in a number of cases **malaria** is responsible for acute exudations of the knee-joint, as is proven by the presence of plasmodia in the blood, and by the immediate therapeutic effect of large doses of quinine.

Malaria.

Tuberculosis of the Knee-Joint (Fungus, Tumor Albus).

As in all other tuberculous affections of the joints, the symptoms of this infection depend upon whether the disease starts in the bone, infecting the joint only after perforation, or primarily in the capsule. If the **tuberculous focus** is **osteal,** the pain in the bone is of a piercing character, occurs mostly at night, and exists long before any changes in the joint can be seen or felt. To make a diagnosis at this early stage, *x*-ray photographs are essential; it is possible to find faint shadows where tuberculous foci in the bone exist, and we may then advise trephining of the bone before the joint becomes infected.

Focus in the bone.

If the **disease starts** in the **capsule,** local symptoms become apparent at once, as swelling, tenderness, and so forth. After a very short while the entire synovia of the joint reacts, in many cases, in the form of a hydrops or **effusion of the joint.** In other cases we find the granulating form, or **fungus,** where the entire surface of the synovia is covered with tuberculous granulations, or in still another form, we find a cold abscess of the joint.

Affection starting from the synovia.

In the case of **tuberculous hydrops,** the affection of the joint itself does not give any characteristic signs, and the diagnosis of tuberculosis must rest upon the accompanying factors, such as hereditary predisposition, the age of the patient (as tuberculosis happens more frequently in young patients), the scrofulous general habitus of the patients, with or without other tuberculous affections, and the manner in which the hydrops developed, either spontaneously without any fever, or as the result of a very slight trauma; finally, the further behavior of the hydrops, which does not yield to the usual treatment (as rest, compression, and

Tuberculous hydrops.

so on), but continues. The absolute, strictly scientific diagnosis is usually impossible, as tubercle bacilli are mostly not found in the effusion. The macroscopic appearance of the fluid is characteristic, and must suffice for diagnosis. The presence of rhizoid bodies speaks for tuberculosis exclusively.

Fungous form.

The **fungous form** is usually accompanied by a slight hydrops also, but the principal symptom is the **swelling of the capsule** and the **proliferation of the granulations** on the synovia. This produces a pseudo-fluctuating, elastic enlargement of the joint, especially in the region of the articular gap, of characteristic spindle form. This appearance is accentuated by the atrophy of the muscles, especially of the quadriceps.

Typical position of knee in later forms.

In the later stages, the **skin** becomes **thinned and shiny,** and frequently a network of blue veins is observed. The proliferations on the synovia soon begin to **interfere** with **voluntary motion,** and the knee is usually held in **flexion at an obtuse angle,** which gradually changes to an acute one. At the same time the **leg is rotated outward** and **abducted.** In still later stages, the granulations break down and form an abscess, finally filling the joint with pus. At this time the **temperature,** which may have been until then nearly normal, **rises,** and the patients frequently have 102° in the evening, while the morning temperature may be normal. The **general condition** of the patients becomes **worse;** they lose appetite, flesh, etc. If, finally, a **fistula** is formed, which shows the typical tuberculous character, surrounded by a wall of glassy, pale, flabby granulations, the discharge is seropurulent, turbid, and mixed with small flakes.

Cold abscess.

The last form, **cold tuberculous abscess** of the joint, is much **rarer,** and its true character is frequently not recognized until the joint is opened. This the more as fever may be absent, but the general condition ought at least to lead to a suspicion of the disease. **Exploratory puncture** will decide the question.

In cases where the clinical symptoms do not lead to the diagnosis, **animal experiments** ought to prove the existence of tuberculosis (the fluid gained by puncture is injected into the peritoneal cavity of guinea-pigs or rabbits).

If we see the patients only in the **later stages,** when the tuberculous process has healed, we may observe as its result a considerable **shortening of the limb** due to a contraction in flexion. In some cases the **tibia** becomes **subluxated** upon the femur.

Syphilis of the Knee-Joint.

Luetic synovitis.

Syphilitic affection of the **knee-joint** may occur in the secondary or tertiary stage. It produces a unilateral or bilateral synovitis, and may affect other joints at the same time. Its course is usually chronic; it very rarely leads to suppuration, is exceedingly painful, especially at night, and interferes very little with the function. The diagnosis rests on the anamnesis (doubtful), the presence of other luetic symptoms, and, in questionable cases, on the result of antiluetic treatment. Hereditary syphilis may also affect one or both knee-joints; frequently other joints are attacked. This form leads sometimes to suppuration of the knee-joint.

Other Inflammations of the Knee-Joint.

The knee in hæmophilia.

Knee Hæmophilia.—If it is not known that the patient is hæmophilic, the diagnosis may become exceedingly difficult. Either spontaneously or after a very slight trauma, the patient suddenly presents, without pain or fever, an effusion, the bloody character of which can be proven only by exploratory puncture (aseptic!). Frequently the blood is not absorbed as in other cases, but leads to adhesions and finally to contractions. The knee is in flexion and in a valgus position. The contraction may become very pronounced.

Rheumatism.

Chronic rheumatism of the joint is usually considered an internal disease, and is of interest to the surgeon only for differential diagnosis. The affection is usually **multiarticular,** its principal symptom is pain, which changes in intensity; locally, thickening of the articular ends of the bones, rigidity and contraction of the joint can be found. Frequently we can feel, and sometimes hear, a distinct grating during motion.

Arthritis deformans.

Arthritis deformans of the knee is not rare. It may occur as a polyarticular disease, or affect only the knee. As a rule persons over forty years of age are affected; the symptoms are indistinct in the beginning; later on we frequently find free articular bodies and "snowball" crackling, or real crepitation. The extreme motions of the knee are lost, the pains are most severe in the morning, or after rest generally, while slight motion is favorable.

Neuroses.

The **neuropathic affections** of the knee-joint are either simple **neuroses of the knee,** without any anatomical basis (wherefore this diagnosis should be made only after most careful examination and the complete absence of any anatomical changes), or the **result of central lesions**

(Charcot's arthropathies), especially in **tabes.** The disease is frequently observed before the ataxic stage of tabes, where suddenly an acute hydrops develops either spontaneously or after very slight trauma. At the same time we find a **doughy infiltration** of the leg from the thigh down to the ankle, and soon **crepitation** and large raw bone surfaces can be felt. In some cases the disease leads to a **complete destruction of the joint.** Pain is entirely absent; **fractures occur not infrequently.** Tabetic affection of knee-joint.

Free bodies in the knee-joint occur not only in arthritis deformans, but also in apparently perfectly healthy young individuals after comparatively slight trauma. **The only symptom** is **functional;** if a free body becomes wedged in a certain position during motion, the **joint will be fixed.** It is sometimes difficult to feel a free body, as it can be detected only in a certain position of the joint. An *x*-ray picture is of great value. Free bodies.

Paralytic deformities occur in slight forms of paralysis, most frequently in infantile paralysis; they will assume the form of genu recurvatum, and can easily be recognized as such.

Spring knee (*genou à ressort*) is parallel to the snapping (spring) finger. Extension of the knee is normal to its extreme degree, while the last part of it occurs suddenly with a snap.

For **differential diagnosis** I might mention an affection which really does not pertain to the knee itself, but in which all the symptoms seem to indicate an affection of the knee. It is **aneurism of the popliteal artery,** producing pain, flexion, tenderness, numbness in the region of the peroneal nerve, and loss of function. Exact examination will soon reveal the true condition, as soon as one thinks of the possibility of such a diagnosis. **Aneurism of the vein** has also been observed. Aneurism of popliteal artery.

Knock-knee and Bow-leg (Genu valgum et varum).

Knock-knee may be due to **rickets,** and then occurs between the first and fifth years. The deformity is produced by a sharp bend of the bone, the lower epiphysis of the femur as well as the head of the tibia. Frequently the capsule is very loose and the joint lax. Besides this etiology, we find (much more frequently) the **knock-knee of growing persons,** which is due to improper weighting of the lower part of the skeleton during adolescence. The deformity is produced by overdevelopment of the inner condyle. Etiology.

Very frequently knock-knee is **combined with flat-foot,** produced

by the same conditions, though in some cases the patients hold their feet in the club-foot position to be able to put their entire sole upon the ground. There is no real pain connected with the deformity, but the patients become tired very easily.

To measure the angle of knock-knee.

To measure the degree of knock-knee we have to know that normally the centre of the head of the femur, the middle of the patella, and the instep are in one straight line. In knock-knee the distance of the articular line of the knee from this straight line gives the degree of the deformity.

In strong flexion the deformity disappears.

Bow-leg.

Bow-leg is practically always the result of rickets. It is, therefore, **usually bilateral,** and is produced by a sharp bend in the epiphysis. In most cases the big toe points inward, and complete extension is usually impossible, otherwise the function is little influenced.

Tumors of the Knee.

Exostosis.

The bones constituting the knee-joint quite frequently show **exostoses** near the same. This is especially true of the femur, where, in the epiphyseal line, we find more or less pointed bony excrescences, frequently with a cartilaginous surface. While they are usually extra-articular, they may simulate an affection of the knee.

Sarcoma.

Besides these benign tumors we find (much more frequently) **malignant tumors** of the bones, especially **sarcomas.** The lower epiphyseal line of the femur is a place of predilection for sarcoma, which finally may "blow up" the bone so that only a very thin bony cover is left, which may, on pressure, produce **parchment crackling.** Even before the tumor perforates into the joint, it produces a **symptomatic hydrops** of the knee. Early diagnosis is very difficult or impossible, although exceedingly desirable.

The **malignity** varies greatly. The **myelogenous** sarcomas with giant-cells are **comparatively benign,** while tumors with large and small **round cells** are **exceedingly malignant.**

Lipoma arborescens.

Of really intra-articular tumors we can only mention the **lipoma arborescens,** a peculiar condition where the entire synovial membrane is covered by innumerable more or less elongated fatty tumors. The affection is regarded by most observers as tuberculous.

Diseases of the Bursæ.

There are a number of synovial bursæ in the region of the knee, which may become the seat of disease. Of these the prepatellar bursa, and the

bursa poplitea or semimembranosa are most important, while the pretibial and infrapatellar bursæ are of less interest.

Prepatellar bursitis occurs in its acute or chronic form as housemaid's knee. Housemaid's knee.

The acute form is the result of some small wound or inflammation of the integument, whence the inflammation spreads into the bursa. It is extremely painful; the skin may be reddened and hot to the touch. Palpation shows fluctuation unless the tension is very high. The serous form is usually accompanied by no fever, while formation of pus is characterized by the typical symptoms of acute inflammation. It is necessary to know that this bursa, like other bursæ near the joints, sometimes communicates with the latter.

The **chronic serous form** is either a residuum of acute inflammation, or the result of a continued slight insult, as kneeling, scrubbing, etc. The size of the more or less fluctuating tumor varies from that of an egg to that of a fist, and cannot be overlooked. There is little functional disorder connected with it. The presence of such a chronic bursitis gives the indication for extirpation.

Tuberculous infection is not very rare and shows the same symptoms only with less fluctuation, as the bursa is mostly filled with tuberculous granulations. The tuberculous character is usually not recognized until operation. Tuberculous bursitis.

The semimembranous bursa gives rise to the so-called **knee-cysts;** they can be felt and seen only when the knee is held in extension, and disappear on flexion. Careful palpation will reveal their presence. Aneurism has to be excluded. The functional disorders are more pronounced than in other forms of bursitis. Knee-cysts.

As the **inflammation** is always **chronic,** and the bursitis of serous character, the tumor itself is not tender on pressure, and usually not very movable. If the bursa connects with the joint, its contents can be pressed into the latter, and return after the pressure is relieved. An **extirpation** ought to be recommended as soon as the diagnosis is made (operation is difficult and should be performed only by experienced surgeons).

As there are small **glands in the hollow** of the knee, they may become the seat of acute, or chronic, or tuberculous infection.

Aneurisms of the knee have been mentioned above.

INJURIES AND DISEASES OF THE LEG.

CONGENITAL DEFORMITIES.

Absence of tibia.

Congenital defect of the tibia is rare. It may be either **partial or total.** If the deformity is partial, the lower part of the tibia is absent; the lower epiphysis of the femur is usually not strongly developed, frequently the fibula is more developed than normally, especially in its epiphyseal ends. At the same time the fibula is strongly bent backward or outward; in many cases the patella is absent. The **principal symptoms** are the pronounced constant flexion of the knee-joint, and a varus or equinovarus position of the foot. One therefore finds the calf pressed against the thigh and the sole of the foot looking directly upward.

Congenital Absence of the Fibula.

Wherever the **fibula** is **absent,** the **tibia** shows such a characteristic **angular flexion,** that the deformity has frequently been described as an intrauterine fracture. Usually the absence of one or more toes accompanies this deformity.

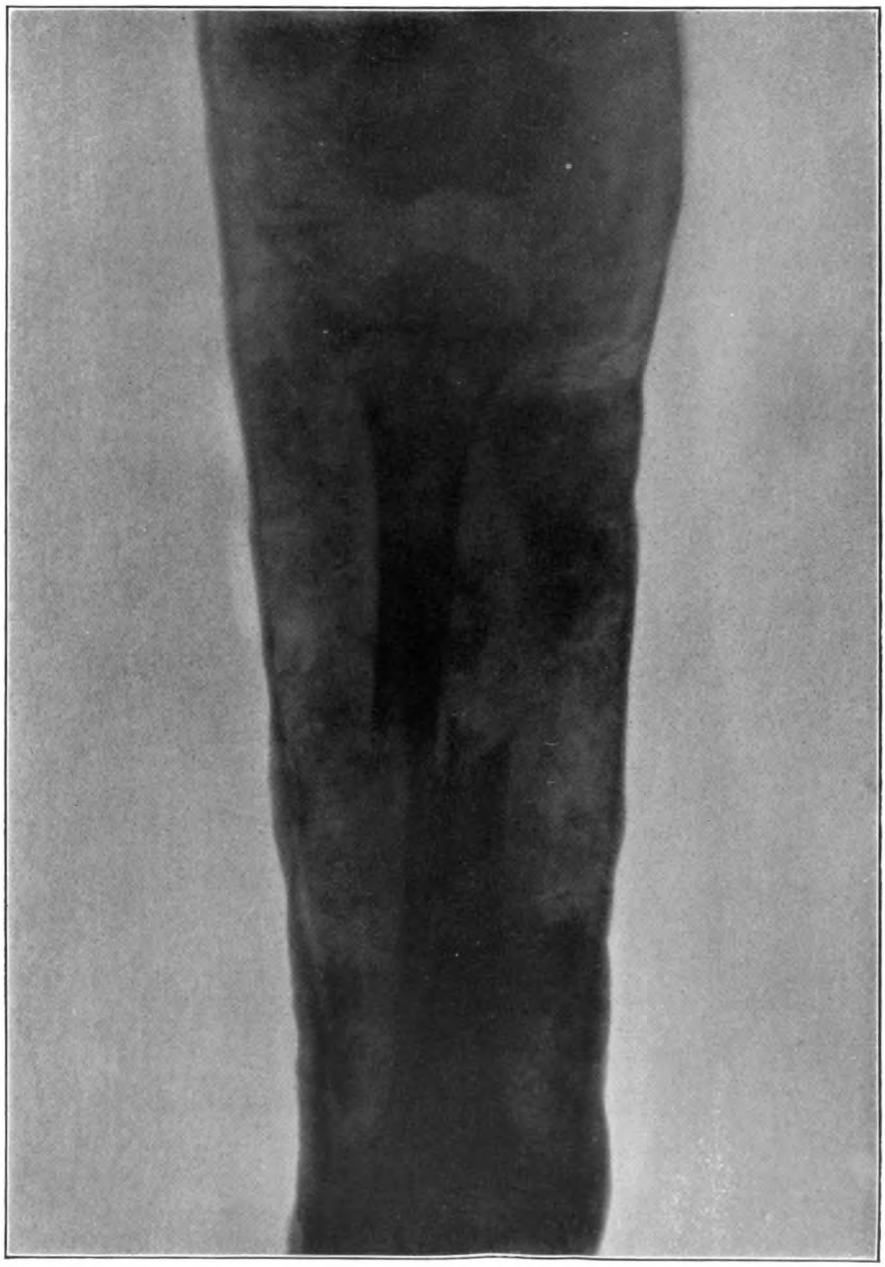
Absence of fibula.

The entire limb is atrophic, the thigh as well as the leg. The leg is decidedly shortened and shows below the middle a sharp angle upward and backward, as mentioned above, with an obtuse angle of about 150° open posteriorly. At the same time the complete or partial absence of the fibula can be felt. *X*-ray photographs will, of course, clearly show the true condition.

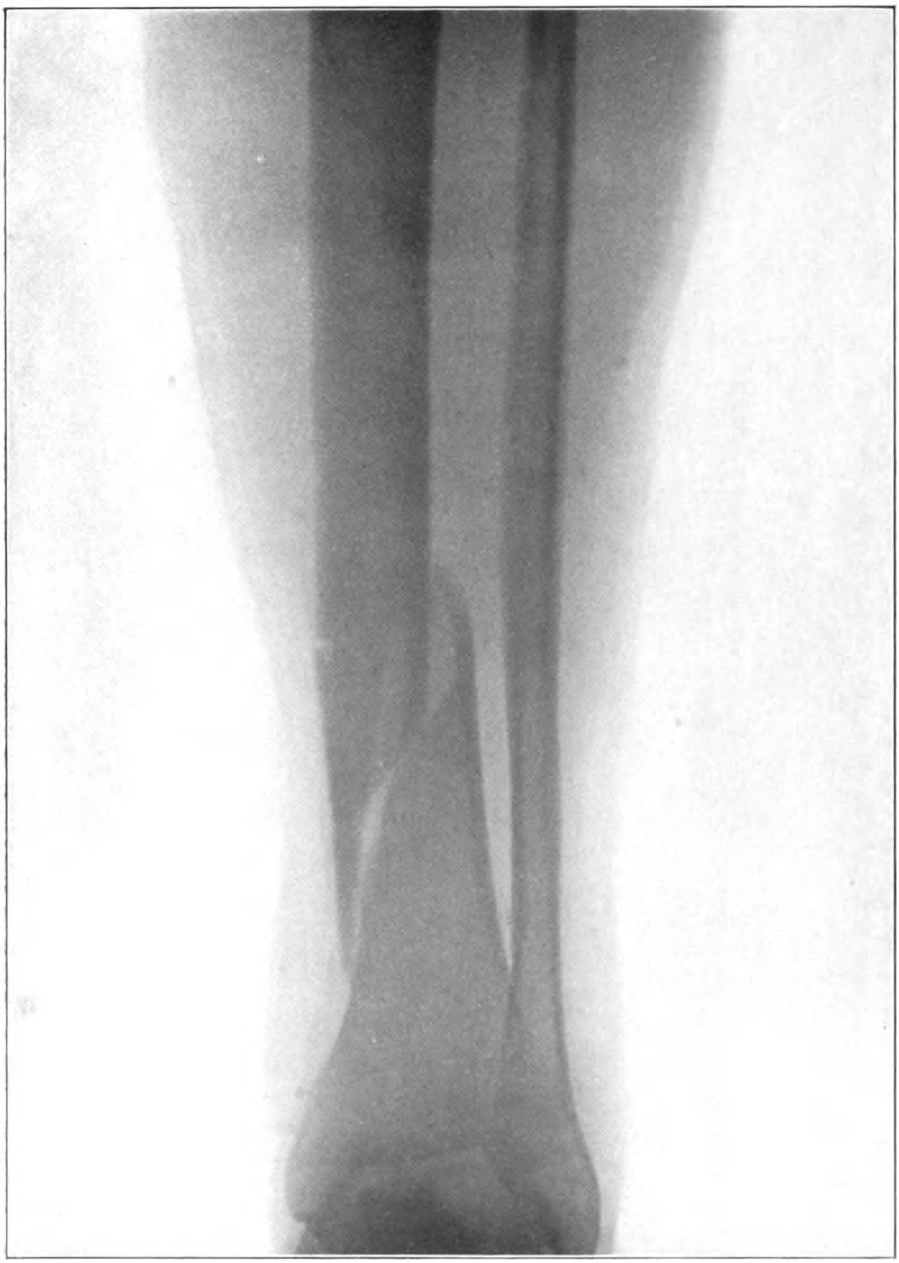
INJURIES OF THE LEG.

Fractures of the Shaft of the Bones of the Leg.

Infractions of the two bones are rare. **Complete transverse fractures** of both bones are usually produced **by direct force,** especially by being run over. The break is practically entirely in a horizontal plane, and only the anterior line is slightly serrated, a tooth protruding at the distal fragment.

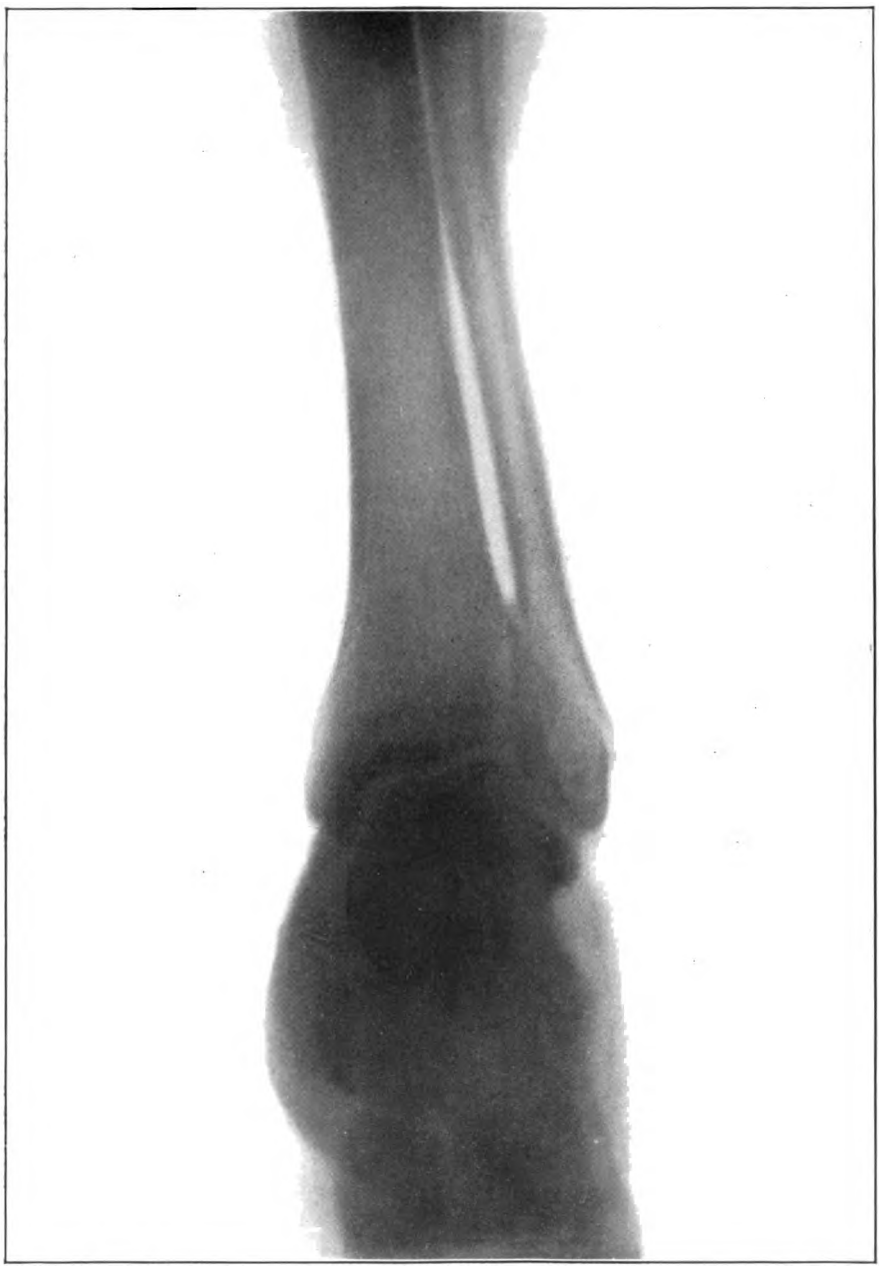


FRACTURE OF TIBIA AND FIBULA IN PLASTER.
Note bad adaptation of fragments with no outside deformity.



SPIRAL FRACTURE OF TIBIA, LOWER THIRD.
Note nick in proximal fragment, two inches above the lowest point.

SPIRAL FRACTURE OF TIBIA, LOWER THIRD.
Same fracture as case in Plate LII.



ISOLATED FRACTURE OF FIBULA AT DISTAL END.

Oblique fractures are much more common. The **line** of separation usually runs **from above externally downward and inward.** At the same time the plane of the break shows a direction from behind and above downward and forward. The upper fragment is very frequently sharply pointed, which has given the fracture the name of *fracture en flute,* although the comparative object has been wrongly selected, as the fragment really resembles the mouthpiece of a clarionet and not that of a flute. This **sharp point** frequently **perforates the skin,** thus making the fracture compound. The diagnosis rests on the typical symptoms of any fracture, pain, abnormal mobility, crepitation, deformity, and impairment of function. The lower part of the leg is usually rotated outward, which is easily seen if one draws an imaginary line from the big toe along the inner edge of the patella to the crista ossis ilii.

Oblique fractures frequently compound.

Fractures by Indirect Force and Torsion.—If, for instance, the patient's body is forcibly turned outward while standing, a **spiral fracture** is frequently produced, which shows typically at the proximal fragment an extra nick about two inches from the lowest point. I have within a short time seen two such cases in succession, the plates of which are here shown. Besides this, some of these fractures show, of course, much splintering if the force producing them is very violent.

Spiral fractures.

In **fractures of both bones** of the leg, the break of the fibula is usually not at the spot where the tibia breaks, and it sometimes requires a little care to find the former. As in all fractures, palpation may be so painful, and the swelling, after a short while, so pronounced, that the exact diagnosis of the character of the fracture may become extremely difficult, even necessitating **narcosis.** Abnormal mobility and crepitation are, of course, absent if the fracture is impacted. Crepitation may be absent too, if muscles are interposed between the fragments. The examination has, of course, to be carried out with such care as not to transform a subcutaneous into a compound fracture.

Fracture of both bones.

Isolated fractures of the **fibula** are **rare.** Those of the **tibia** still **more so.** The symptoms are about the same, but as the other bone is not fractured, the displacement of the fragments is less prominent. **Isolated fracture of the tibia,** as the bone which carries the weight, immediately produces impairment of function.

Isolated fractures.

Fractures of the fibula may not produce any functional disturbance at all. The principal symptom is pain, exactly located at the spot of the fracture. Crepitation is rare. The fibula may break in either the middle or upper or lower third. The break in the middle is always the result

Fracture of the fibula.

of direct force, as a blow with a stick, or a kick by a horse. The fracture at the upper end is sometimes the result of muscular traction. It becomes of interest if the callus formed during the healing of the fracture exerts **pressure on the peroneal nerve,** which may necessitate operation. Isolated fracture of the lower end of the fibula I show on Plate LV.

Dislocation of the fibula.

Dislocation of the fibula is extremely rare, except luxation at the upper end, which may occur if the growth of the tibia is arrested, owing to some disease of the bone, such as osteomyelitis. **Dislocation at the malleolus** is very rare as an isolated injury, while quite frequent in combination with other injuries of the foot.

If the interposition of soft parts between the fragments of the fracture of the leg is not reduced, the result is **pseudarthrosis.** The symptoms are those of a fracture in a chronic state, so to speak. We find deformity, abnormal mobility, more or less pronounced impairment of function but, of course, no crepitation.

DISEASES OF THE LEG.

Diseases of the Soft Parts.

Of the diseases of the soft parts of the leg, chronic eczema, ulcer of the leg, and varicose veins are by far the most important, and, at the same time, frequently closely related. Besides these chronic processes, acute infections after wounds, scratches, and so on, occur; but, even if they appear as lymphangitis, erysipelas, etc., they present no differentiating peculiarities from those in other parts of the body.

Chronic ulcer of the leg.

The principal cause for the formation of **chronic ulcer** of the leg is poor nourishment of the skin, due to varicose veins of the lower extremity. The ulcers are usually situated below the middle, and show all sorts of variations. As an etiological factor, we have, in many cases, to search for **syphilis;** as the anamnestic data in this direction are usually of little value, except when positive, and as many non-syphilitic ulcers frequently have the appearance of specific ones, it is, in many cases, indicated to try antiluetic treatment for diagnostic purposes. If the luetic ulcer is typical in its appearance, we find its edges sharply defined, as if punched out, with characteristic lardaceous coating of the granulations. They occur more frequently on the upper parts of the leg, while the common ulcer is usually situated below the middle. Specific ulcers usually heal under antiluetic treatment very quickly, unless we find varicose veins at

Luetic ulcer.

the same time. **Rust-brown spots** do not indicate syphilis; they are the residue of small subcutaneous hemorrhages. They may occur at the seat of ulcers, or elsewhere.

Varicose veins are most frequently found in women who have borne children, though men who have to stand a great deal during heavy work are also subject to them. The disease affects the superficial or the lower branches of the veins, especially the saphena, or both. If they are not very pronounced, they can easily be demonstrated if the patients stand up, and constriction, if necessary, is applied above the knee to retard the back flow of the blood. We then either find bluish, transparent, thick, sometimes pouchy veins, in which we feel, once in a while, a **phlebolith,** or we find the very superficial, finest radicals of the veins transformed into closely woven nets, involving especially the ankles and the dorsum of the foot. The **symptoms** are quite pronounced; the patients are unable to stand any length of time or to walk, are very easily tired, and finally unfit for work. At the same time the pains may become very violent. Varicose veins.

Sometimes the wall of the veins becomes thinned, and the overlying skin ulcerated, so that quite a serious hemorrhage may ensue.

Leprosy of the Lower Extremity.

This shows all the characteristic signs of either tubercular or anæsthetic leprosy. In the early stage, the dusky **erythematous maculæ** with hyperæsthesia or areas of anæsthesia are very characteristic; in the advanced grade pale forms, they cannot be mistaken for anything else. In case of doubt, **microscopical examination** for bacillus lepræ is in order. The disease in the United States is located in Louisiana, California (imported by the Chinese), and Minnesota; there are some cases also in certain counties of Canada, and in Manitoba and British Columbia. In the West India Islands and Mexico it is endemic. Leprosy.

Elephantiasis, if well developed, is unmistakable. The disease usually attacks patients between the fifteenth and twentieth years, and the first attack is generally accompanied by a chill, fever, etc. Finally the endarteritic and enlymphatic inflammatory attacks occur again and again, producing that **characteristic ungainly deformity** typical of elephantiasis. Elephantiasis.

Diseases of the Bones of the Leg.

Like other bones, those of the leg show the three typical inflammatory diseases of bone: osteomyelitis, tuberculosis, and syphilis. **Acute osteomyelitis of the tibia** is more frequent than that of any other bone. The principal **symptoms** are those **of an acute infectious disease**: severe headache, chill and fever, general prostration, and besides these, violent pain in the bone, especially at night, described as lancinating. The function is usually completely suspended, the patients are unable to move the limb; the affected part and, later on, nearly the entire tibia are exceedingly tender on pressure. **Acute periostitis** can be seen and felt, the swelling in the beginning is sometimes circumscribed, but later on becomes more diffuse, œdematous, and doughy. *X*-ray pictures may show even at the earliest stages the focus of the infection. **As soon** as the **diagnosis is made,** or even if it cannot be decided with absolute certainty, **operation,** exploratory if necessary, **is indicated.**

Osteomyelitis of the tibia.

In other cases the course is more subacute. The **osteomyelitic affection** of the **bone** results very frequently in **disturbances of its growth,** and may thus lead to a number of different deformities, especially of the feet. If the affection leads to **perforation** and formation of a **fistula,** this is usually an indication of **sequestration.** The inserted probe (under necessary precautions) usually easily feels the denuded bone which, if loose and entirely dead, gives the peculiar "cracked-pot sound." At this stage an involucrum of new bone has been formed, in the cloacæ of which the old sequestrum is embedded.

Formation of a sequestrum.

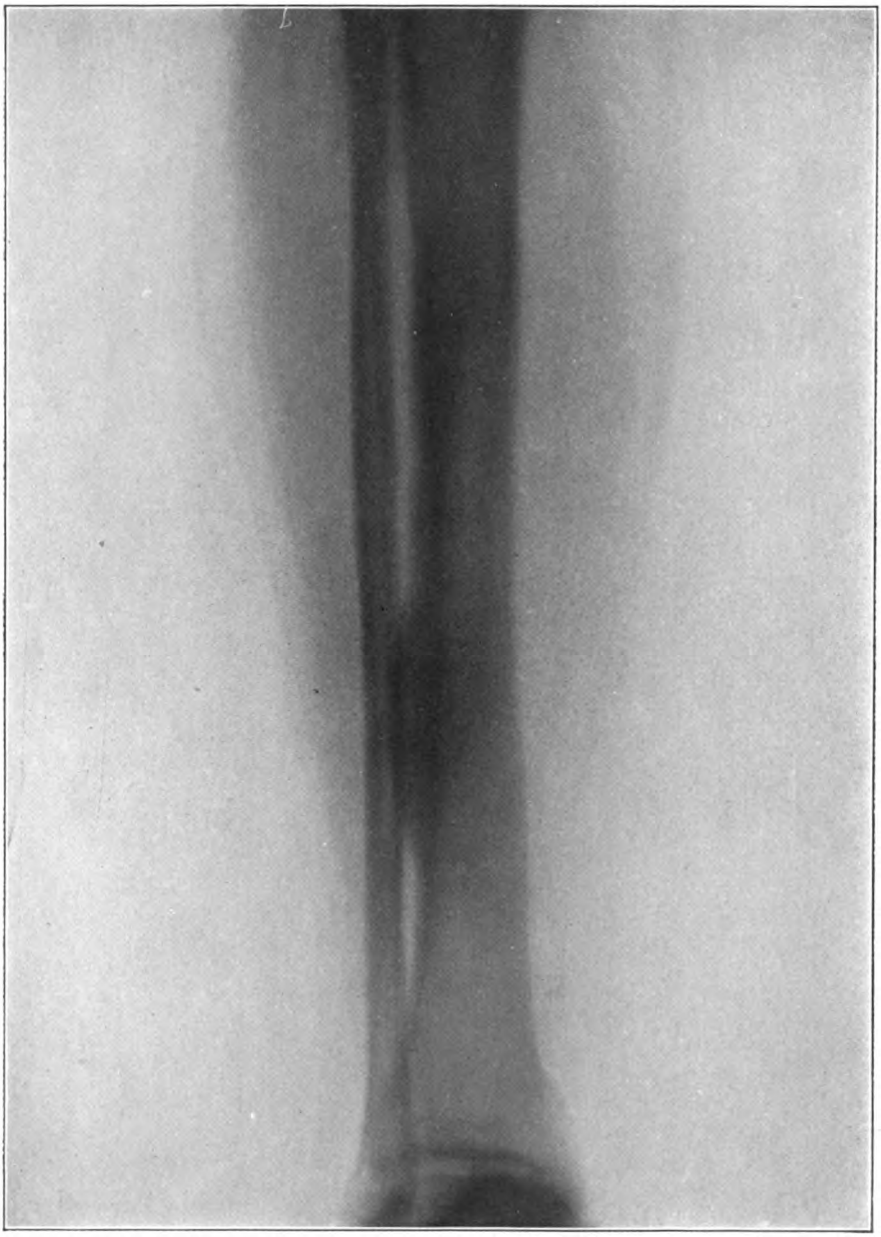
The former method of waiting, if circumstances would permit, until the sequestrum should be loosened in its entirety, has been given up lately, and, according to my experience at least, immediate operation has always been of great value.

Tuberculosis of the diaphysis of the tibia is rare, according to its tendency to affect the epiphyseal ends of the bones. The symptoms are those of other tuberculous affections of the bone; the course is usually more chronic. If the diagnosis is doubtful at all, exploratory trephining for microscopical examination is permissible.

Tuberculosis.

Syphilis of the tibia is **very frequent,** that of the **fibula more rare.** Typical is **luetic periostitis,** which is responsible for the well-known thickening of the anterior surface of the tibia, so that it bulges forward. If the bone itself is attacked, the patients complain of more or less dull, boring pain, increased at night. If the patient acknowledges a syphilitic

Syphilis of the tibia.



PERIOSTITIS LUETICA OF TIBIA.
Forming interosseous bridge.

infection, the diagnosis is easy, being based on the symptoms mentioned. If this anamnestic point is lacking, differential diagnosis has to exclude other diseases of the bone, as subacute osteomyelitis, tuberculosis, sarcoma of the bone, etc. Tentative specific treatment is found of value.

Rickets.

The **deformities** produced by **rickets** are **unmistakable.** The bony changes brought about by rickets in the upper epiphyseal end of the tibia have been described under the heading of knock-knee and bow-leg. The **affection** of the **tibia and fibula,** in **the middle and below,** produces the well known **" dachshund " legs.** There is a strong bending forward and outward at the same time. If the bend forward is more pronounced we call it **" scabbard deformity."** Early diagnosis of a general rhachitic disposition is of importance to prevent premature walking, as long as the bones are abnormally soft, without proper support. While the disease lasts, the children cry a great deal, especially at night. If the children do walk, they tire very easily and often give up any further attempts at walking until the disease has passed. Even then, while there is no functional disorder, the walk is unsteady and unsightly, similar to that of a duck. **General symptoms of rickets are:** late closure of the fontanels, late dentition, prominence of the frontal tuberosities (giving the head a square shape), the "rhachitic rosary," that is, thickening of each rib at the junction with its cartilage, and abnormal thickening of the lower epiphyseal ends of the bones of the forearm and leg.

Deformity caused by rickets.

General symptoms of rickets.

Tumors of the Leg.

Of the tumors of the soft parts, **carcinoma** of the leg is the most interesting. It develops usually on the basis of old ulcers of the leg. If the aspect and form of the tumor do not suffice for the diagnosis, the **probatory excision** of a small part **for microscopical examination** is indicated. The course of the carcinoma, while slow, is characteristic. The ulcer heals frequently in its central part only; in its outer edges at the same time, knobby, wart-like excrescences are formed, and **the edges** of the **ulcer are thickly infiltrated.** The **discharge** is often profuse, and frequently of a **specific bad odor.** The **prognosis** is comparatively good in comparison to other carcinomatous growths; nevertheless, as soon as the character of the disease has been established, **amputation** of the leg should be recommended.

Carcinoma.

Sarcomas, especially melanosarcomas, occur also on the skin of the leg, though rarely.

By far more important are the **tumors of the bones** of the leg, especially sarcoma. Of **benign tumors** we have to mention **enchondroma,** which usually starts from the upper epiphyseal line of the tibia and produces a large lumpy tumor of knobby surface and hard cartilaginous or bony consistency, finally absorbing the entire bone. It frequently betrays a tendency to sarcomatous degeneration, but even if not, its presence may make **amputation** necessary, because of the destructive influence on the bone.

Enchondroma.

Echinococcus.

Echinococcus also occurs with a certain predilection in the tibia. If the bone is not inflated, so to speak, by the cyst, and if periosteal new formation of bone is absent, the affection may remain entirely unobserved until spontaneous fracture occurs, which may be the first symptom of the disease; this is possible, as the affection is absolutely free from pain. If echinococcus cyst should be suspected, exploratory trephining, to prove the presence of the "hooklets," might be indicated.

Sarcoma of the bone.

Sarcomas occur in both varieties; first, the comparatively less malignant **myelogenous** sarcoma with giant cells, which usually grows slowly. The increase in the size of the bone is quite pronounced, as the periosteal new formation of bone keeps pace with the destruction of the bone by the tumor.

The other, **periosteal form** belongs usually to the spindle and round cell sarcoma and is characterized by very rapid growth, by the sometimes enormous size it achieves, and by the early involvement of the surrounding soft parts. The **early diagnosis** is **as difficult as it is important.** If any doubt as to the character of a new growth of the leg exists, probatory excision for **microscopical examination** ought to be insisted upon.

INJURIES AND DISEASES OF THE ANKLE-JOINT AND FOOT.

CONGENITAL DEFORMITIES.

By far the most frequent congenital deformity of the foot is **club-foot,** pes equinovarus. Its early recognition is of importance, as correction is much easier while the children are very young. A slight degree of club-foot is normal for children in their first months; it is produced by the intrauterine position of the fœtus.

Club-foot.

In **pronounced club-foot** the foot is **turned on its outer edge,** the inner edge points upward, the outer downward; in short, the **foot** is **in supination.** Besides this, the point of the foot is lowered and turned inward beyond the position produced by supination. **Besides congenital club-foot** we find other reasons for this deformity, as **traumas, static changes, diseases** of the bones, scars, and diseases of the joints. Seventy per cent of all non-congenital cases of club-foot are produced by **paralysis of the muscles,** owing to neuropathic conditions, especially **after infantile paralysis.** Strange to say, the latter disease affects the right foot twice as often as the left. In pronounced cases, the toes are flexed and cannot be extended, which is infaust for the prognosis. Besides the supination of the foot, a shortening of the plantar fascia is produced, which holds the foot in plantar flexion. There is in most cases a decided shortening of the Achilles tendon.

Paralytic club-foot.

The **deformity** becomes **more pronounced** when the children **stand** than in the recumbent position. The deformity can be demonstrated by **auto-prints.** The patients are required to step on glazed paper, similar to that used for sphygmography, coated with lamp-black. After they have stepped off it very carefully, the imprint is fixed by a spray of shellac. In congenital club-foot all the muscles of the leg are atrophied, but have retained their electric excitability, while in paralytic club-foot the muscles show the reaction of degeneration.

The **other congenital deformities** are very rare, as pes calcaneus, pes valgus, pes cavus, and (talipes) equinus. The respective position of the

foot in these deformities is expressed by the name. All these deformities may be **acquired** in later life as the result of paralysis of muscles (**paralytic**), of static influences (**static**), of spasms of muscles (**spastic**), or of injuries (**traumatic**).

Flat-foot.

By far the most important, because the most common, acquired deformity of the foot is so-called **flat-foot,** comprising under this name two entirely distinct varieties, which have hardly anything to do with each other, viz., **pes valgus** and **pes planus.** In pes valgus the foot stands **in abduction and pronation,** in pes planus the arch is simply **flattened.**

Between these two varieties there are a number of **intermediate stages,** which come to the observation of the practitioner for their functional disorders.

Anatomical etiology.

If the muscles supporting the arch and its ligaments are unable or neglect to do their duty, the body rests on the arch of the foot as a dead weight. If the lower line of the arch is permitted to give (by stretching of the ligaments if the arch breaks down), the upper edges of the wedge-shaped bones constituting the arch must necessarily be pressed together. This produces pain; thus the severest symptoms of flat-foot—pain, unelastic gait, spastic contraction of the foot with loss of its mobility—may be present before the foot is at all flat. This is the type of beginning pes valgus. On the other hand, perfect flat-foot, pes planus, with practically no discomfort, may be inherited, as in negroes, Indians, the Jewish race, etc.

Static flat-foot **develops** most frequently between the **fifteenth and twentieth year,** usually in frail persons with weak muscles, who have grown quickly and have had to do hard work, especially standing, walking, and carrying, during adolescence, such as bakers, waiters, blacksmiths, servants, nurses, etc. But even strong individuals may develop flat-foot if they grow fat quickly.

Professional etiology.

Anamnesis.

The **diagnosis of so-called flat-foot,** even if not flat, is usually easy if the cases are examined carefully. The patients generally complain in the early stages of a certain **weakness of the foot** and a feeling of **strain** at its inner edge. To avoid this pain, the muscles are held in contraction and never entirely relaxed during the contraction of the antagonists; therefore **pain** occurs in the **calf, knee,** or **hip.** In many cases the heel hurts, patients have difficulty in selecting the proper shoe, sweating of the foot develops with coldness and numbness. Later on, the motions become more limited, and the foot is finally fixed in that position which was at first assumed only under the pressure of the weight of the body.

Examination shows the following condition: when the inner malleoli and the inner edges of the feet are placed together, there is in normal feet **a gap** between the **inner edges;** if they touch, or if there is a slight convexity toward each other, instead of a concavity, we have to deal with a flat-foot in the early stages. An imprint of the sole of the foot on blackened paper, as described above, gives us the contour of the supporting surface. Characteristic symptoms.

The **motions** of the foot are **limited**—dorsal and plantar flexion, as well as supination, abduction, and adduction. The line of direction of gravity of the foot should fall between the second and third toes; if it approaches the mesial plane, the distribution of leverage is wrong, and the foot is flat.

This is shown in the action of the foot, the gait. The patients turn their feet outward in an exaggerated manner, and walk on their heels; the gait is unelastic, the foot is not "rolled off" the ground, the knees are slightly flexed.

A condition very similar to flat-foot is found in anterior **metatarsalgia** or Morton's joint. The metatarsal bones normally have a **transverse arch** (in a frontal direction). If this arch sinks down, it broadens the foot and the metatarsal bones are exposed to lateral compression by the shoe; the **pain** is mostly felt in the **fourth toe** and is **spasmodic** in character. The patients experience **a cramp** in the joint named, sometimes after they have had a feeling that something in the foot slipped. It is typical that patients remove their shoes and stockings and press, twist, and rub the foot to relieve the cramp. If this condition is recognized, simple orthopedic treatment in the form of a support for the arch should be recommended. Morton's joint.

Excessive hypertrophy of an entire extremity (as in acromegaly) occurs with extreme rarity; partial hypertrophies are a little more frequent. The enlargement may affect either all the tissues, bones, and soft parts, or only the latter. Hypertrophy.

Congenital elephantiasis sometimes cannot be differentiated from partial hypertrophy.

All of these deformities are of more purely scientific interest, and their study is of little practical value. **Operations** are indicated only when the function of the extremity is impaired.

Frequently we find an **irregularity in the number of toes,** which may be either an increase or a decrease (polydactylism or brachydactylism); the former is frequently connected with macrodactylism, the latter with Deformation of the toes.

microdactylism. Besides this **ectrodactylism** occurs: a complete absence of one or all toes. **Syndactylism** of the toes occurs with the same frequency, and to the same degree, as that of the fingers. All these deformities become of practical interest only when they interfere greatly with the function of the extremity and foot. The usefulness of the foot can be improved by operation, which ought to be most conservative.

INJURIES OF THE ANKLE-JOINT AND FOOT.

Sprained ankle.

Of all the injuries of the foot, sprain (distortion, wrench) is by far the most common. It is due to the same force, only less violent, that produces fractures. The **principal symptom,** and at first the only one, besides pain, of a sprained ankle is **loss of function.** The patients, who have usually fallen down, are unable to rise, or, at least, to stand on the injured foot. Even the most careful inspection and palpation do not reveal anything except **local tenderness on pressure.** The most painful region is that immediately below the external and internal malleoli, where pressure can be exerted on the ankle-joint. Sometimes there is a pronounced tenderness in the instep, where the dorsal flexors pass under the anterior annular ligament. After a short while, the regions named above appear puffed up, owing to an effusion into the joint and into the sheaths of the tendons.

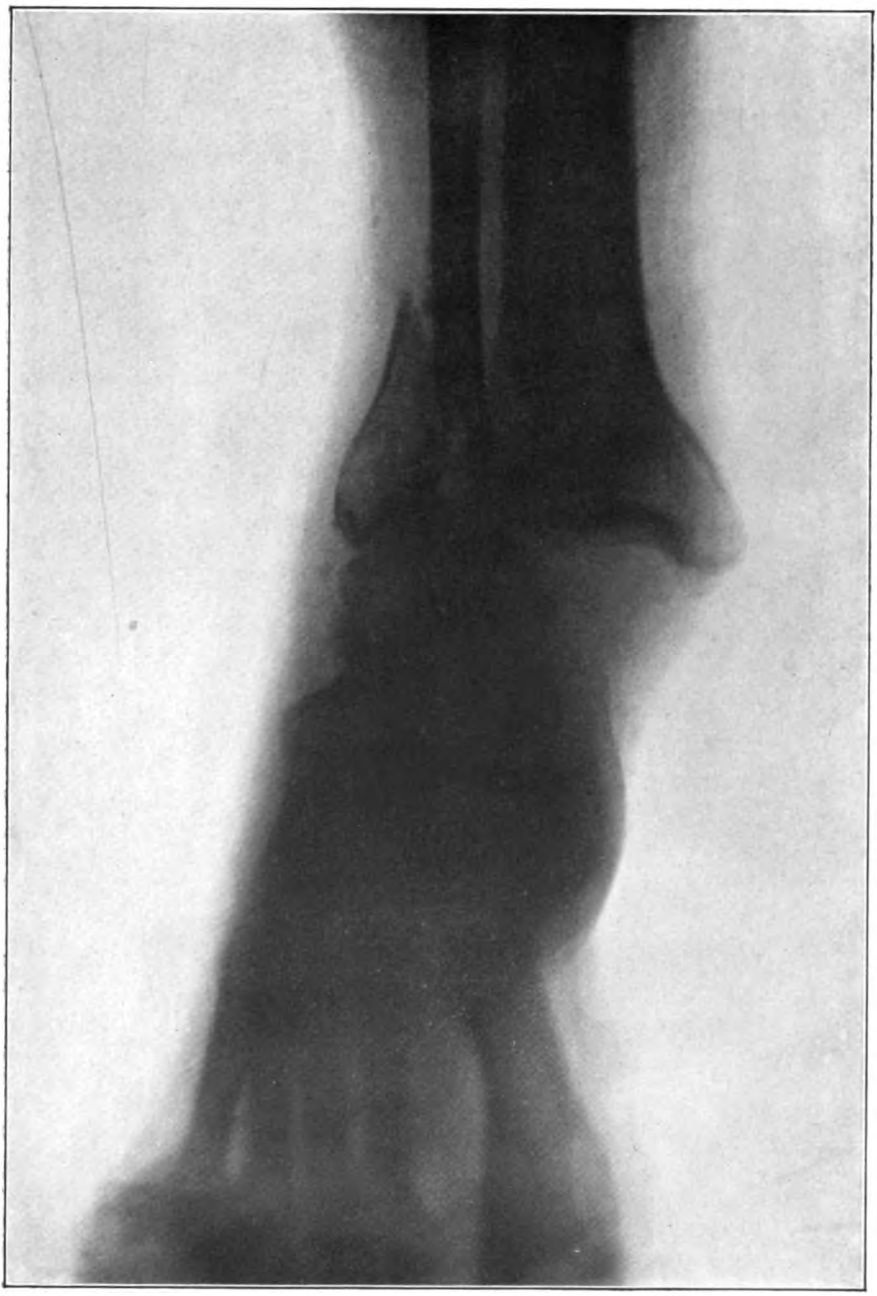
Differentiation from fracture of malleoli.

For a long time special stress was laid upon the **differentiation** of simple distortions **from malleolar fractures.** Since then, the treatment has been changed so greatly that it is only important to decide if there is a fracture through the broadest part of the malleoli (about an inch above the lowest point of the bone). If the lowest portion of the external or internal malleolus is torn off by the lateral or internal ligament of the ankle-joint, the injury is not considered a fracture, but belongs to the distortions. The breaking off of the lowest part of the tibia may be due to another mechanism. If the torsion of the foot is brought about by its being forced into flat-foot position, then the internal ligament will be stretched beyond its elasticity until it partly tears, and the distal end of the fibula will be pried off.

Tear of the Achilles Tendon.

Symptoms.

This injury is due to a **forcible contraction** of the **muscles** of the calf. If the force is more violent, it produces **fracture of the os calcis.** The tear may be either complete or partial. It is indicated by a **swelling** in



DISLOCATION OF FOOT OUTWARD WITH SUPRAMALLEOLAR FRACTURE.

Only the lateral point of the malleolus of the tibia is broken off.

COMMINUTED FRACTURE OF CALCANEUS.

Fall upon the feet from a height of ten feet. Also fracture of vertebræ.

the region of the tear, and a **gap,** which is more pronounced if the separation is complete. It can best be demonstrated if the leg is put in extension, and the foot placed in dorsal flexion.

Tearing of other tendons has not been observed, except that of the plantar fascia (very rare).

Dislocation of Tendons.

Only the **dislocation of the peroneal tendons** is known. The injury is mostly due to an unusually **strong contraction** of the **peroneal muscles** during the act of jumping, if the patients, landing on the feet, come down in pronounced pronation of the foot. To permit luxation of the tendons, the **annular ligament** must be **torn.** Examination shows that **the tendons,** usually situated behind the external malleolus, **have left their normal place,** and slipped out of their groove. The ankle appears swollen, and the tendons can be felt to be loose, so that they can be rolled in a sagittal direction. The **function of the foot** is **suspended.** Either one or all of the tendons of the peroneal group may be dislocated; they can easily be brought into place with a snapping sound, but the deformity reappears immediately, as soon as the foot is abducted. Symptoms.

This injury occurs not only alone, but also as a complication of fractures.

Fractures Near and in the Ankle-Joint.

Supramalleolar fractures really belong to the chapter on fractures of the leg, but as they frequently involve the joint, I mention them here. The fracture usually occurs one or two inches above the ankle-joint, and is due either to direct force, as being run over, etc., or to indirect force, where the patients fall on the feet from a considerable height. The **fracture of the tibia** is usually so **oblique,** approaching the perpendicular axis, that it practically always penetrates the joint. The **inner part** of the **tibia** has a tendency to **slip inward and downward,** while the outer fragment of the tibia remains in place. This produces a **shortening** of the **limb,** and forces the **fragments of** the **fibula** into an **angular position.** The distal fragment usually lies on top of the proximal one, and its sharp point can often be felt just beneath the skin. Supramalleolar fracture of the tibia.

Besides this deformity all other symptoms of fracture are present: loss of function, pain, swelling, abnormal mobility, and crepitation. If the force, after producing the fracture, is not exhausted, the fragments

of the tibia, as well as that of the fibula, perforate the skin, thus producing a compound fracture. A very short while after the injury, the swelling may be so pronounced as to interfere with exact palpation, and the examination so painful that an anæsthetic may become necessary. Skiagram!

Fractures Through the Malleoli.

Pott's fracture.

These injuries are typical, very frequent, and may produce various deformities. By far the **most frequent form** is Pott's fracture, where the lowest part of the **tibia** (**external malleolus**) is **torn off,** and the **fibula broken** (secondarily) usually about two inches above the joint; the foot is in abduction and pronation. These fractures are usually the result of exaggerated normal pronation of the foot.

But practically the **same** type of **fracture** may be effected through a **forced outward rotation of the foot** (in rare cases by rotation inward); for instance, if the foot of a person, while running, becomes wedged between rails, and the momentum throws him with his full weight inward. **Besides** the **abduction** named above, the foot is in **pronation,** or valgus position, so that the longitudinal axis of the limb, which usually passes through the space between the first and second toes, does not reach the

Typical deformity.

foot at all, which is entirely outside (laterally from) the axis. The **inner malleolus protrudes** sharply under the skin, the **horizontal axis** of the ankle-joint is **lengthened.** There is a **sharp inward bend** of the **fibula,** about two to three inches above the external malleolus. If the patient, after the leg has been fractured, tries to stand on it, the deformity is still more increased, and the upper fragment of the tibia may perforate the

Other symptoms.

skin. After a short while the **symptoms of hemorrhage** from the fractured bone become apparent: swelling, fluctuation, ecchymosis. If the suggillation is very pronounced, it is pathognomonic for fracture, differentiating the same from a sprain, where the hemorrhage is only slight. **All other symptoms** of **fracture** are usually **present:** exactly localized pain, spontaneous as well as on pressure, loss of function, abnormal mobility, crepitation. Pain at the place of fracture can usually be elicited by circular compression in the middle of the leg, or by lateral compression of the malleoli with two hands. **Abnormal mobility** is very **pronounced,** so that the foot permits of an abnormal rocking motion. Palpation may be somewhat difficult after the swelling has become very great. If this is the case, we may have to use more force during the examination, which thus becomes so painful as to necessitate an anæsthetic.

While I have considered the breaking off of the lowest point of the malleoli only as an exaggerated sprain, these malleolar fractures, where the break goes through the thickest part of the internal malleolus, at least, are of the highest importance, and offer, if not recognized as such and treated accordingly, a very bad prognosis.

Dislocations of the Foot.

All malleolar fractures may result in **dislocation** of the foot, if the force, after having produced the fracture, is not exhausted. Dislocations of the foot in the ankle-joint (articulatio talo-cruralis) are possible in the **sagittal** and **frontal direction.** Sagittal dislocations are either forward or backward; frontal, either outward or inward. They may be either complete or incomplete, more frequently the latter. The deformity is exceedingly striking, and cannot be overlooked. Details of the displacement of the bones can, of course, best be seen in skiagrams.

Varieties.

Dislocation of the foot **forward** is **exceedingly rare. Dislocation backward** a little more frequent. **Dislocation outward** is **very common** and is an exaggerated Pott's fracture. **Dislocation inward** is **extremely rare.**

Dislocations in the four directions named may occur in the talo-calcaneal joint, either in the form of luxatio pedis sub talo, or isolated dislocation of the astragalus. The skiagram will usually show the true condition, but even if that cannot be employed, one ought to be able to recognize the dislocation. If the result of a dislocation, a pronounced adduction of the foot (in dislocation inward), cannot be corrected in efforts to set the foot, and if the examination of the ankle-joint does not give any explanation for this resistance, we ought to think of a possible dislocation in the talo-calcaneal joint.

Dislocations in the talo-calcaneal joint.

The **isolated dislocation of the astragalus,** where this bone is torn from all its connections with the bones with which it articulates, shows the same four variations, namely, dislocation forward, backward, inward, and outward; the diagnosis is not difficult. If the deformity is partly concealed by the post-accidental swelling, an anæsthetic must be employed, so that a most thorough examination may be possible.

Dislocations of the astragalus.

In **dislocation forward,** the **foot** is in **plantar flexion,** the tibia has slipped down on the tarsus, the points of the malleoli are nearer the sole of the foot than normal, the foot appears elongated, the astragalus can be felt under the skin at the dorsum of the foot. **Dislocation** of the

Dislocation forward.

astragalus **backward** makes the **foot** appear **shortened,** the body of the astragalus is to be felt between the tibia and Achilles tendon. At the anterior surface, below the tibia, where the astragalus normally can be felt, one detects a depression.

Dislocation outward.

Dislocation outward brings the foot into **varus position** (club-foot position). It may be so pronounced that the sole of the foot looks directly inward. On the dorsum of the foot the astragalus can be felt under the skin, as a marked prominence laterally from the mesial line of the foot. This dislocation is very frequently compound.

Dislocation inward puts the foot in **valgus position** (flat-foot position). It is abducted and in slight plantar flexion.

Dislocations of the calcaneus, and in Chopart's joint, are so extremely rare as to make their description unnecessary.

Fractures of the metatarsal bones are much more frequent than has been formerly assumed. With the help of the skiagram they cannot possibly be overlooked. The aid of the Roentgen rays is of special value in these cases, as **practically all symptoms** of **fracture** are **absent except pain** and **impairment of function** to a certain degree. The second and third metatarsal bones have been found fractured, usually in the middle part. The fourth and fifth seem to be more rarely fractured, although I have a number of plates showing fractures of the fifth metatarsal bone. The first seems never to break.

Fractures of the metatarsal bones.

Fractures of the phalanges are rare, except by direct force, and usually can be easily recognized. In case of doubt the skiagram will solve it.

Dislocations.

Dislocations in the tarsometatarsal joint are rare, and occur also in the four possible directions: outward, inward, upward, and downward.

Dislocation of the hallux upward is not very rare, and corresponds to the dislocation of the thumb, presenting a very similar clinical picture, and the same difficulties in reduction.

DISEASES OF THE ANKLE-JOINT AND FOOT.

Diseases of the Soft Parts of the Foot.

Inflammations.

Phlegmons and other infections of the **foot** are very **rare** compared with those of the hand. This is doubtless due to the fact that the foot is less exposed to infections. **Small suppurations** of the foot, due to infections, scratches, wounds, and so on, offer no peculiar symptoms,

except that they **might be overlooked** owing to the presence of callous, **thickened skin on the sole** of the foot. As the callosity of the skin does not very readily permit perforation of a small abscess outward, the pus has a tendency to infect deeper parts, and **frequently** thus **two abscesses** are formed, one under the aponeurosis, and the other under the thickened skin. They are usually connected with each other by a narrow canal. All other affections of the foot of small importance, as **corns** and the like, become of real surgical interest only if they give rise to infectious processes. It is important to note that quite frequently **small bursæ** are formed under corns. If they become infected they are usually exceedingly painful, out of all proportion to their size and importance.

Hyperidrosis.

Hyperidrosis frequently produces small cracks between the toes, which may become exceedingly painful. They must not be mistaken for syphilitic psoriasis, which is quite common. It appears in the form of papulous scaling. Syphilis, lupus, and tuberculosis of the skin occur not very uncommonly in the foot.

Chronic inflammations.

Elephantiasis is well known. It affects the foot with a certain predilection in its characteristic forms.

Chilblains of the toes and heel are exceedingly common. They are the result of exposure to the cold, and are to be recognized by their symptoms: swelling, redness, tenderness, vesication, sometimes sloughing or ulceration.

Ingrown nails are **ulcers** produced by improperly cut toe-nails. This ulceration is more frequent in flat-foot, in which there is usually at the same time hyperidrosis. In the foot the inner edge of the big toe is turned upward, the free end of the nail is, therefore, more exposed to pressure, and the skin, being softened by the influence of the sweat, becomes easily ulcerated.

Paronychia is not very rare. The skin at the root of the nail is inflamed; if it is pushed back and the proximal end of the nail is lifted up, pus escapes; the nail is usually partly or entirely loose.

Diseases of the Vessels and Nerves of the Foot.

Aneurisms.

Aneurism is so rare that it requires only a short description. The superficial situation of the dorsal artery, if this vessel is affected, makes the diagnosis very easy, while the aneurisms of the plantar artery of the foot may be mistaken for fluctuating abscesses.

The **endarteritic changes** of the vessels of the foot may be due to a

number of diseases: first **syphilis** (comparatively rarely), then **diabetes** (quite common), and, finally, simple **arteriosclerosis** producing **senile gangrene** (the most common of all). Other forms of less importance are embolism, with subsequent gangrene, and gangrene due to congelation, or frost-bite.

Senile gangrene.

Senile gangrene is characterized first by **violent pains,** accompanied by a **feeling of numbness and cold.** In some cases these prodromal pains are absent, and then we perceive, as the first symptom, a **reddish-brownish spot** on the skin of the toe, which increases until demarcation sets in. In other cases a large part of the foot appears inflamed, resembling a phlegmon; one part of this inflammation will subside, while the other, the distal part, shows later on signs of real gangrene. These forms of gangrene are, with comparative frequency, the **outcome of wounds and infections.** The gangrene is very often attributed to improper cutting of corns, as patients with beginning gangrene ascribe the pain to pressure from thick corns, and, therefore, cut them too deep.

The **diagnosis** is certain only after the gangrene has really established itself, which does not take place until several days, and sometimes weeks, have elapsed. As there is usually no necessity for very early operation, one should wait for demarcation, if possible.

Diabetic gangrene.

Diabetic gangrene occurs in younger, as well as in older individuals, but usually **not** in patients **under thirty-five years of age.** It is also characterized by very pronounced pain, but has, in its later stages, less tendency to demarcation and mummification; it belongs more to the moist form of gangrene.

Ulcers.

Perforating ulcers of the foot (*mal perforant du pied*) are situated on the sole of the foot, usually at the ball of the foot, under the third metatarso-phalangeal joint, and are due not so much to trophoneurotic influences as to the anæsthesia which is a symptom of nervous affections, sometimes in the form of neuritis, sometimes as a central lesion.

Tabes quite frequently produces atrophic ulcers of the skin and nails, perforating ulcers, and so on. If the **toes** are affected in **tabes** they **show swelling** at the epiphyseal ends, with hydrops of the joints. Tabes produces other forms of arthropathy—either a tabetic flat-foot, with complete destruction of the joints in question in the later stages, or a tabetic affection of the ankle-joint, where the thickening of the bones may be so striking as to mislead to a diagnosis of tumor.

DISEASES OF THE BONES AND JOINTS.

Of all the deformities of the toes, **hallux valgus,** commonly called bunion, is the most common. The **toe** in its metatarso-phalangeal joint **stands in abduction,** and this may be so pronounced as to produce **complete dislocation.** At the same time excrescences form in the joint, which make it, with the inflammation which usually exists in the bursa, exceedingly painful. If the skin above the bursa becomes ulcerated, the fistula may communicate with the joint, as the bursa is quite frequently connected with it. Hallux valgus (bunion).

Other bursæ which may become inflamed and are of some importance are the bursa **between the Achilles tendon** and **the calcaneus, and** the one at the lower surface of the calcaneus, called **bursa subcalcanea.** Inflammation of the latter frequently produces that state which is known as **tarsalgia.** The inflammation of both these bursæ occurs with special frequency **after gonorrhœal affections.** Bursitis.

Acute inflammation of the ankle-joint is very frequent. This often is the first joint to be attacked by **articular rheumatism,** which I consider, as I have stated before, a surgical disease as soon as the effusion becomes very marked. **Gonorrhœa** is very frequently the etiological factor for inflammation of this joint. **Gonorrhœal affections** of the ankle-joint are characterized by very pronounced swelling, excessive painfulness, and a **great tendency to suppuration;** exploratory puncture has therefore to be used, repeatedly if necessary, to see if the effusion has become turbid. As soon as this is the case, the joint ought to be emptied and washed out. It is safest, though, to recommend operation in all cases of gonorrhœal affection of the joint. The other joints of the foot are not so frequently affected. Acute inflammations.

Chronic inflammations of the foot and toes are due to **rheumatism,** to **arthritis deformans,** or to **gout.** The latter affects, as is well known, with predilection the metatarso-phalangeal joints of the hallux. After a number of attacks **tophi** are formed, chalk deposits, which may finally give rise to the formation of abscesses and fistulas. If this is not the case, these tophi usually become the object of surgical interference in extreme cases only; otherwise the principal surgical interest in these gouty formations is not to mistake them for other diseases, which call for operation. Chronic inflammations.

Syphilis of the foot, affecting the bones or joints, or both, is not very frequent. If it occurs, it does not show any variation from like affec- Syphilis.

tions in other parts of the body, especially in the hand. The ankle-joint is sometimes the seat of lues, but much less frequently than the elbow or knee-joint. Acquired syphilis usually shows itself in periostitic or ostitic forms with other indications of that disease, which facilitate the diagnosis.

The recognition of the disease may become difficult only in **congenital forms** in children, where the **differential diagnosis from tuberculosis** may not be easy, the more so as syphilis and tuberculosis may exist together. All congenital forms are characterized by the exceedingly slow course and absence of pain. The principal symptom is impairment of function of the affected joint, or joints.

For diagnostic purposes antiluetic treatment may be employed; but this is of more value in acquired syphilis than in the congenital forms.

Tuberculosis.

Tuberculosis of the foot is much more frequent, especially that of the **ankle-joint.** This affection is but **rarely primarily synovial,** but is usually due to an **osseous process** which soon affects the joint. Of all the bones of the foot the **astragalus** is most frequently attacked, next come the lower epiphysis of the tibia, then the tarsus, and, finally, the small bones of the metatarsus. The phalanges, if affected at all, show the clinical picture of spina ventosa.

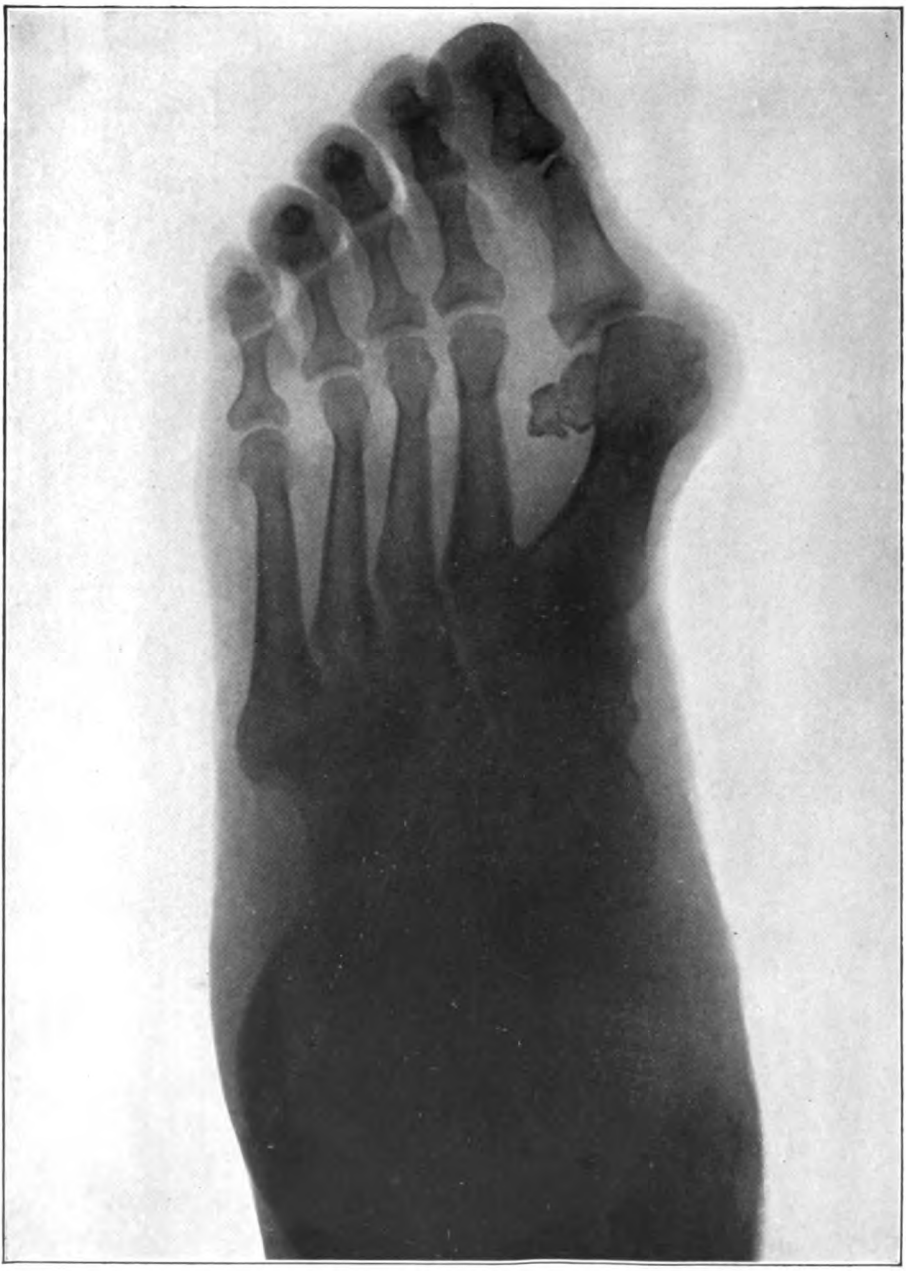
The **first symptom of tuberculosis** of the tarsus (or of any other bone of the foot) is **pain.** As tuberculosis is, in many instances, started by trauma, the differentiation may sometimes be quite difficult; but if the pain is protracted, irregular in its type, and decidedly increased at night, we may suspect tuberculosis, if that disease is rendered probable by the family history, as well as the general habitus of the patient. **Early skiagrams** will help greatly, if good and read properly. There is no question that even small foci of tuberculous granulations in the bone can be brought to view in Roentgen photographs, as I have done repeatedly. This is most important, as the early diagnosis thus gained gives a chance for operation before the joint has become infected.

Further course.

Later on, the **capsule** of the neighboring joint, even before being itself affected, **shows thickening,** which appears as an **indistinct swelling** over the joint. This can be well differentiated from a **hydrops** of the joint, which is **not very frequent** in tuberculosis of the foot. Soon after, the ligaments and sheaths of the tendons become involved, and show a thickening. The **affection** of the **soft parts** is **not characterized** by **pain,** and the entire course is usually rather chronic. The general symptoms are those of any other tuberculosis of the joint, only in a less marked

ASTRAGALECTOMY FOR TUBERCULOSIS.

Arteriosclerosis of both tibial arteries. Black shadow near joint is iodoform tampon.



HALLUX VALGUS, WITH ARTICULATED EXOSTOSIS.

degree, owing to the size of the joint. Some rise of temperature is hardly ever absent.

Tuberculosis of the lower end of the tibia and the **os calcis** is, while less frequent than that of the astragalus, not rare, and shows not much difference in its symptoms, except that the affection of the calcaneus may remain occult for a longer period, by reason of the peculiar anatomical position of the bone. Tuberculosis of the tibia and calcaneus.

The **prognosis** of tuberculosis of the foot varies greatly, as in all other tuberculous affections, with the age of the patients. The older they are the worse it is; conservative methods ought to be recommended only in very young persons.

Tumors of the Foot.

They are rare and show few peculiarities if they do occur.

All the various forms of **benign** tumors have been observed, on and off. Chondromas and osteomas are less rare. In the latter category we include the **exostoses,** which grow beneath the **nail,** especially of the **big toe.** They are usually situated under the middle of the nail, and loosen it by lifting it up. The affection is painful, quite out of proportion to its importance, and necessitates surgical interference. The condition can usually be easily recognized after the nail has become loose. Exostosis of the hallux.

The **sole of the foot** sometimes shows the formation of papilloma and warts, which may have to be removed.

The **malignant forms** are represented by sarcoma and carcinoma, both rather rare. The former frequently starts from pigmented spots of the skin. Of the bones of the foot the calcaneus is most subject to sarcoma. Carcinomas sometimes show a comparatively benign course, especially those which occur in the sole of the foot. Because of the constant insults to which they are exposed they become very painful. Therefore, even if the carcinoma appears in the form of an ulcer it can never be mistaken for *mal perforant,* which is completely anæsthetic. Sarcoma and carcinoma.

TABLE I.

GENERAL SYMPTOMS.[1]

Identical Symptoms Found in Various Diseases.

HEAD.

Anæsthesia	Brain	**Compression of brain.** **Cerebral hemorrhage.** **Meningitis.** Softening of the brain.
	Medulla	Ataxia. **Compression.** Myelitis.
	Nervous affections	**Epilepsy.** Hysteria.
	Skin	Lepra nodosa. Lichen. Pemphigus.
	Digestive tract	Dyspepsia. **Gastric disturbance.** Typhoid fever. Gastralgia.
	Intoxications	Carbonic acid. Alcohol. Hasheesh. Narcotics. Lead.
Ataxia		General paralysis. Hysteria. **Tabes dorsalis.**
Cephalalgia (*Cont'd on p. 423.*)	Affections of cranium and its integuments	Hysterical headache. **Erysipelas of scalp.** Neuralgias. Rheumatism of scalp. **Syphilis.**
	Organic nervous diseases	Cerebral anæmia. Cerebral congestion. **Suppurative encephalitis** (abscess of brain). **Cerebral hemorrhage.** Hydrocephalus. Meningitis. **Solid tumors of the brain.**
	Dynamic nervous diseases	Epilepsy. Hysteria.

[1] This and the following tables are selected and translated from "Tableaux Synoptiques de Diagnostic," by Dr. Coutance. Surgical diseases are printed in heavy type.

- **Cephalalgia** (*Cont'd from p. 422.*)
  - Dyscrasic diseases...
    - Anæmia.
    - Chlorosis.
  - General diseases.....All acute and eruptive infectious diseases.
  - Poisoning.
    - Acute..
      - Opium.
      - Belladonna.
      - Hemlock.
      - Alcohol.
      - Sulphate of quinine.
    - Chronic.
      - Alcohol.
      - Lead.
- **Coma** (see Table II.).....
  - Epilepsy.
  - Hysteria.
  - Typhoid fever.
  - **Meningitis.**
  - **Apoplexy** (of brain).
  - Softening of brain.
  - **Tumors of the brain.**
  - **Uræmia.**
  - Eclampsia.
  - Alcoholism.
  - Lead poisoning.
  - Belladonna poisoning.
  - Opium poisoning.
- **Contractions**.....
  - **Cerebral hemorrhage.**
  - **Meningitis.**
  - **Tumors of the brain.**
  - **Compression of the medulla.**
  - Myelitis.
  - Hysteria.
  - Cholera.
- **Convulsions**.....
  - Brain.....
    - **Meningeal hemorrhage.**
    - **Meningitis.**
    - Cerebrospinal meningitis.
    - **Cerebral tumors (tubercles).**
  - Medulla .....
    - **Compression.**
    - General epilepsy.
    - Myelitis.
  - Nervous diseases ...
    - Chorea.
    - **Epilepsy.**
    - Hysteria.
  - Infections.....
    - **Tetanus.**
    - **Sepsis.**
  - Affections of organs.
    - Eclampsia.
    - Bright's disease.
  - Dyscrasic diseases...
    - Anæmia.
    - Chlorosis.
    - **Hemorrhages.**
  - Intoxications..... ..
    - Alcoholism.
    - Ergotism.
    - Lead poisoning.
    - Carbonic acid poisoning.
  - In children .....
    - Dentition.
    - Indigestion.
    - **Meningitis.**
    - Intestinal worms.

- **Delirium**
  - Brain
    - Congestion of the brain.
    - **Hemorrhage of the brain.**
    - **Œdema of the brain.**
    - **Meningitis.**
    - **Tumors of the brain.**
  - Nervous diseases
    - **Epilepsy.**
    - Hysteria.
  - General diseases
    - Typhoid fever.
    - Acute infectious diseases.
  - Poisoning
    - Opium.
    - Belladonna.
    - Alcohol.
    - Lead.
    - Ergot.
- **Hyperæsthesia**
  - Brain
    - Cerebrospinal meningitis.
    - Softening of the brain.
  - Medulla — Acute and chronic myelitis.
  - Nervous diseases
    - Hysteria.
    - **All neuralgias.**
  - Skin
    - Erythema.
    - Eczema.
    - Lichen.
    - Prurigo.
  - Dyscrasic diseases
    - Anæmia.
    - Chlorosis.
  - Poisoning — All narcotics.
- **Paralysis**
  - Brain
    - Congestion of the brain.
    - **Cerebral hemorrhage.**
    - Progressive general paralysis.
    - Softening of the brain.
    - **Tumors of the brain.**
  - Medulla
    - Anæmia of the medulla.
    - Progressive muscular atrophy.
    - **Compression by tumors.**
    - Congestion of the medulla.
    - Myelitis.
  - Nervous diseases
    - **Epilepsy.**
    - Hysteria.
  - Intoxications
    - Alcoholism.
    - Diphtheria.
    - Lead poisoning.
- **Pain in spine**
  - Spine
    - **Cancer.**
    - **Pott's disease.**
    - **Neuralgia.**
    - Muscular rheumatism.
    - **Tumor albus.**
  - Medulla
    - Congestion.
    - **Hemorrhage.**
    - Cerebro-spinal meningitis.
    - Acute and chronic myelitis.
  - Other organs
    - **Aneurism of the aorta.**
    - Chlorosis.
    - Typhoid fever.
    - Hysteria.
    - **Ulcer of the stomach.**
    - Uterine diseases.
    - Variola.

Prostration	Congestion of the brain. **Hemorrhage of the brain.** Meningitis. Softening of the brain.
Trembling (see Table III.)	Diffuse meningo-encephalitis. Progressive muscular atrophy. Sclerosis. Senility. Parkinson's disease (fingers move as if rolling a cigarette). Alcoholism. Mercurialism.

THORAX.

Pain	**Intercostal neuralgia.** Pleurodynia. **Pleurisy.** Pneumonia. Bronchitis. Tuberculosis. Emphysema. **Pneumothorax.**

LUNGS.

Bulging	**Pleurisy.** **Pneumothorax.** Pneumonia. Bronchitis. Congestion of the lungs. Emphysema. **Empyema.** **Abscess of the lungs.**

HEART.

Absence of impulse of the heart.	**Pericarditis with effusion.** Cardiac adiposis. Cardiac symphysis. Hypertrophy of the heart. Dilatation with thinness of the walls. Softening of the heart. Displacements of the heart. Pulmonary emphysema.
Epigastric pulsations	Hypertrophy of the liver. Nervous pulsations. Lowering of the diaphragm. Cardiac symphysis. Dilatation of the right cavities of the heart. True aneurisms of the heart.
Precordial pain	**Pericarditis.** **Hydropericarditis.** Endocarditis. Lesions of orifices and valves. Hypertrophy. Angina pectoris.

- **Precordial vibratory thrill**
  - Pericarditis.
  - **Aneurism.**
  - Auriculo-ventricular stenosis.
  - Aortic stenosis.
- **Cardiac weakness**
  - Endocarditis.
  - Pericarditis.
  - Hypertrophy.
  - Dilatation of the arch of aorta.
  - **Aneurisms of the aorta.**
  - **Mediastinal tumors.**
  - **Pleurisy of the left side.**
- **Palpitations of the heart**
  - Chlorosis.
  - Anæmia.
  - Disturbances of menstruation.
  - Masturbation.
  - Intoxications.
  - Puberty.
  - Orificial stenosis.
  - **Pericarditis.**
  - Endocarditis.
- **Precordial bulging**
  - Endocarditis.
  - Cardiac hypertrophy.
  - **Pericarditis with effusion.**

ABDOMEN.

- **Ascites**
  - Acute peritonitis.
  - Chronic peritonitis.
  - Peritoneal carcinosis.
  - Cirrhosis.
  - Cancer of the liver.
  - Tumefaction of the **spleen.**
  - Bright's disease.
  - Abdominal tumors **compressing the vena porta.**
- **Constipation**
  - Meningitis.
  - **Stenosis of the pylorus.**
  - Lead colic.
  - **Acute peritonitis.**
  - Enteritis.
  - **Internal strangulation.**
  - **Strangulated hernia.**
  - **Intussusception.**
  - **Stercoral retention.**
- **Diarrhœa**
  - Indigestion.
  - Gastro-enteritis.
  - Typhoid fever.
  - **Tuberculous enteritis.**
  - Dysentery.
  - **Severe icterus.**
  - **Chronic peritonitis** (tuberculosis, cancer).
- **Abdominal pain.**
  - Abdominal wall.
    - Chlorosis.
    - Hysteria.
    - Neuralgias.
    - Muscular rheumatism.
  - Stomach.....
    - Gastralgia.
    - Gastritis.
    - Poisoning.
    - **Cancer.**
    - **Ulcer.**

(*Cont'd on p. 427.*)

- **Abdominal pain.** (*Cont'd from p. 426.*)
  - Intestines
    - Enteritis.
    - Typhus.
    - Colitis.
    - Dysentei
    - Varieties of colic.
      - Intestinal colic.
      - Hepatic colic.
      - **Appendicular colic.**
      - **Nephritic colic.**
      - Ovarian colic.
      - Copper colic.
      - **Ileus.**
      - **Bilious colic.**
      - Colic of stomach.
      - Flatulent colic.
      - Wind colic.
      - Hysterical colic.
      - **Hemorrhoidal colic.**
      - Menstrual colic.
      - Lead colic.
      - Stercoral colic.
      - Uterine colic.
      - Worm colic.
      - Colic of Madrid (metallic rhachialgia).
      - Colic of Poitou (vegetable rhachialgia).
      - Normandy (painters') colic.
  - Peritoneum ..... **Peritonitis.**

- **Dyspepsia**
  - Gastric disturbance.
  - Acute and chronic gastritis.
  - **Ulcer and cancer of the stomach.**
  - **Hernias of the omentum.**
  - Flaccidity of the abdominal walls.
  - Tumors
    - **of the liver.**
    - **of the spleen.**
    - **of the pancreas.**
    - **of the kidney.**
    - **of the omentum.**

- **Borborygmus**
  - Indigestion.
  - Simple enteritis.
  - Tuberculous enteritis.
  - Typhoid fever.
  - **Certain abscesses of the iliac fossa.**

- **Tympanism**
  - Dyspepsia.
  - Typhoid fever.
  - Dysentery.
  - Simple enteritis.
  - **Peritonitis.**
  - **Internal strangulation.**
  - **Strangulated hernia.**
  - **Intussusception.**
  - **Cancer of the stomach.**
  - **Tuberculosis of colon.**
  - **Cancer of gut.**
  - Hysteria.

Vomiting	Migraine. **Meningitis.** **Tumors of the brain.** Pulmonary consumption. Whooping-cough. **Pleurisy** and pneumonia. Acute and chronic gastritis. Poisoning. Gastric disturbance. **Simple ulcer of the stomach.** **Cancer of the stomach.** Gastralgia. Gastro-intestinal enteritis. Cholera. Trichinosis. **Simple acute peritonitis.** Uræmia.

TABLE II.

DIFFERENTIAL DIAGNOSIS OF VARIOUS FORMS OF COMA, WHICH MAY RESEMBLE BRAIN SYMPTOMS IN FRACTURE OF THE SKULL.

Uræmic coma	"Bruit de galop" (triple sound of heart-beat, resembling the galloping of a horse). Cheyne-Stokes (rhythmic) respiration. (See p. 430.)
Diabetic coma	Chloroform odor of breath. Pain in the stomach. Nausea. Vomiting. Diarrhœa. Hypothermia.
Alcoholic coma	Crisis of delirium tremens. Odor of the patient (wine, whiskey).
Lead coma	Dilated pupils. Leaden complexion. Fetid breath. Blue line of the gums. History of accidental lead-poisoning.
Apoplectic coma	Hemiplegia. Deviation of head and eyes to same side. Patient breathes as if smoking a pipe. Stertorous respiration. Frequent pulse. Bloated face.
Eclamptic coma	Preceded by deep inspiration. Dilated pupils. Heavy sleep. History.
Belladonna coma	Dilated pupils.
Opium coma	Pupils like pin-points.

TABLE III.

DIFFERENTIAL DIAGNOSIS OF TREMBLING.

RAPID TREMBLING.

General paralysis.....Trembling of tongue and lips.

Alcoholism.....Trembling of fingers when arm is extended.

Exophthalmic goitre.....**Vertical trembling of whole hand.**

SLOW TREMBLING.

Paralysis agitans.....The fingers move slowly, as if rolling a cigarette.

Multiple sclerosis.....Trembling occurs only during voluntary motion (a glass shakes when the patient attempts to lift it).

TABLE IV.

LIST OF DISEASES, SYMPTOMS, SYNDROMES, AND LAWS DESIGNATED BY PROPER NAMES.

Adams	Syndrome of Stokes-Adams	See Stokes.
Addison, Thomas	Addison's or bronzed-skin disease.	Tuberculosis of the suprarenal capsule.
	Syndrome of Addison	Blackish color of skin. Muscular asthenia. Gastro-intestinal disturbance. Pains in the kidneys.
Babinski	Symptom of toes of Babinski.	The toes are extended instead of being flexed on excitation of the sole; lesion of the anterior pyramid.
Basedow, Karl A. von	Basedow's or Graves' disease	Exophthalmic goitre.
	Syndrome of Basedow	Hypertrophy of thyroid. Exophthalmos. Vertical trembling of hand. Tachycardia.
Bell, Charles	Phenomenon of Charles Bell (in peripheral facial paralysis).	Rotation upward of the eyeball during closure of the lids.
	Bell's symptom of spasm	Spasms of the face.
Bonfils	Bonfils' or Hodgkin's disease.	Adenia.
Broca, Paul	Broca's aphasia	Due to lesion of third left frontal convolution (in right-handed persons).
Charcot, Jean Marie	Charcot's joint disease	Arthropathy of the tabetic.
	Charcot-Leyden's crystals (in asthma and gangrene of the lung).	Octahedral crystals.
	Charcot's disease	Amyotropic lateral sclerosis.
	Trembling of Charcot-Marie (in exophthalmic goitre).	Vertical trembling of hands.

Cherchewski, M.	Cherchewski's disease	Nervous ileus in neurasthenia, or false intestinal obstruction.
Cheyne, John	Cheyne-Stokes symptom (in uræmia and tubercular meningitis).	Rhythmic respiration consisting of: 1. A state of apnœa. 2. A series of inspirations in decreasing progression. 3. Another state of apnœa.
Chopart, François	Chopart's or Stokes' law	Every muscle subjacent to an inflamed serous membrane is paralyzed. (Example: constipation in ascites.)
Chvostek	Chvostek's symptom (in tetanus).	Mechanical excitability of nerves and muscles.
Cooper, Astley P.	Astley Cooper's hernia	Crural hernia with multilobular sac.
Erb, Wilhelm	Erb's symptom (in tetanus)	Reaction of pupil to pain. Increase of electric excitability.
Graefe, Albert von	Graefe's symptom (in Basedow's disease).	Asynergy of motion of lower lid and eyeball.
Grasset, Joseph	Grasset's law (in cerebral hemorrhage).	Patient looks toward the paralyzed side.
	Grasset's symptom (in cerebral hemorrhage).	Contraction of sternocleidomastoid of paralyzed side.
Graves, Robert J.	Graves' disease	See Basedow.
	Graves' trembling	Whole hand trembles.
Hodgkin, Thomas	Hodgkin's disease	Adenia, see Bonfils. Pseudoleukæmia.
Hoffmann	Hoffmann's symptom (in tetanus).	Pressure of nerves excites spasms in cutaneous regions affected with paræsthesia.
Holzinger	Holzinger's symptom	Reflex of hypothenar, caused by compression of the region of pisiform bone.
Hutchinson, Jonathan	Hutchinson's teeth	Indentations of the free edge of incisors.
Jackson, John Hughlings	Jacksonian epilepsy	Partial epilepsy.
Kernig, Woldemar	Kernig-Netter's symptom	Inability to separate the knees when seated.
Landry, J. B. Octave	Landry's disease or syndrome.	Ascending paralysis with rapid development, beginning in lower extremities and quickly affecting the whole body.
Lannelongue, Odilon	Lannelongue's tibia	Syphilitic tibia (swelling of whole bone and bulging of middle portion), not to be confounded with rhachitic tibia (convex in front, concave behind).
Leyden, Ernst von	Charcot-Leyden's crystals	See Charcot.
	Leyden's disease	Pseudotabes. Subphrenic pyopneumothorax.
Littre, Alexis	Littre's hernia	Diverticular hernia.

Ludwig, C. F. W. (Ludovicus)	Morbus or Angina Ludovici	Infectious infrahyoid phlegmon.
McBurney	McBurney's spot (in appendicitis).	Painful spot situated in the middle of a line connecting umbilicus with anterior superior iliac spine.
Moeller	Moeller-Barlow's disease	Subperiosteal hæmatoma, occurring under two years of age, analogous to rhachitic hæmatoma, with which this must not be confounded.
Paget, Sir James	Paget's symptom	Eczema of mammilla, precursor of cancer.
Petit, Jean Louis	Petit's triangle	Formed by crista ossis ilii, latissimus dorsi, obliquus externus.
Pott, Percival	Pott's disease	Tuberculosis of the spine.
Recklinghausen, Friedrich Daniel.	Recklinghausen's disease	General neurofibromatosis.
Romberg, Moritz H.	Romberg's symptom	Staggering gait and fall of tabetic patients in the dark.
	Romberg's symptom	Disturbances in the region of the obturator nerve, in incarcerated obturator hernia.
Rosenbach, O.	Rosenbach's symptom	Absence of abdominal reflex.
Stokes, William	Syndrome of Stokes-Adams	Permanent slow pulse.
Trousseau, Arm.	Trousseau's spots (in tubercular meningitis).	Reddish coloring of the lines on the belly of the patient.
Vulpian, E. F. A.	Vulpian and Prevost's law (in cerebral hemorrhage).	Deviation of eyes and rotation of head to same side. Patient is said to look at his lesion.
von Wahl	Wahl's symptom	Halituous bruit in axillary aneurism.

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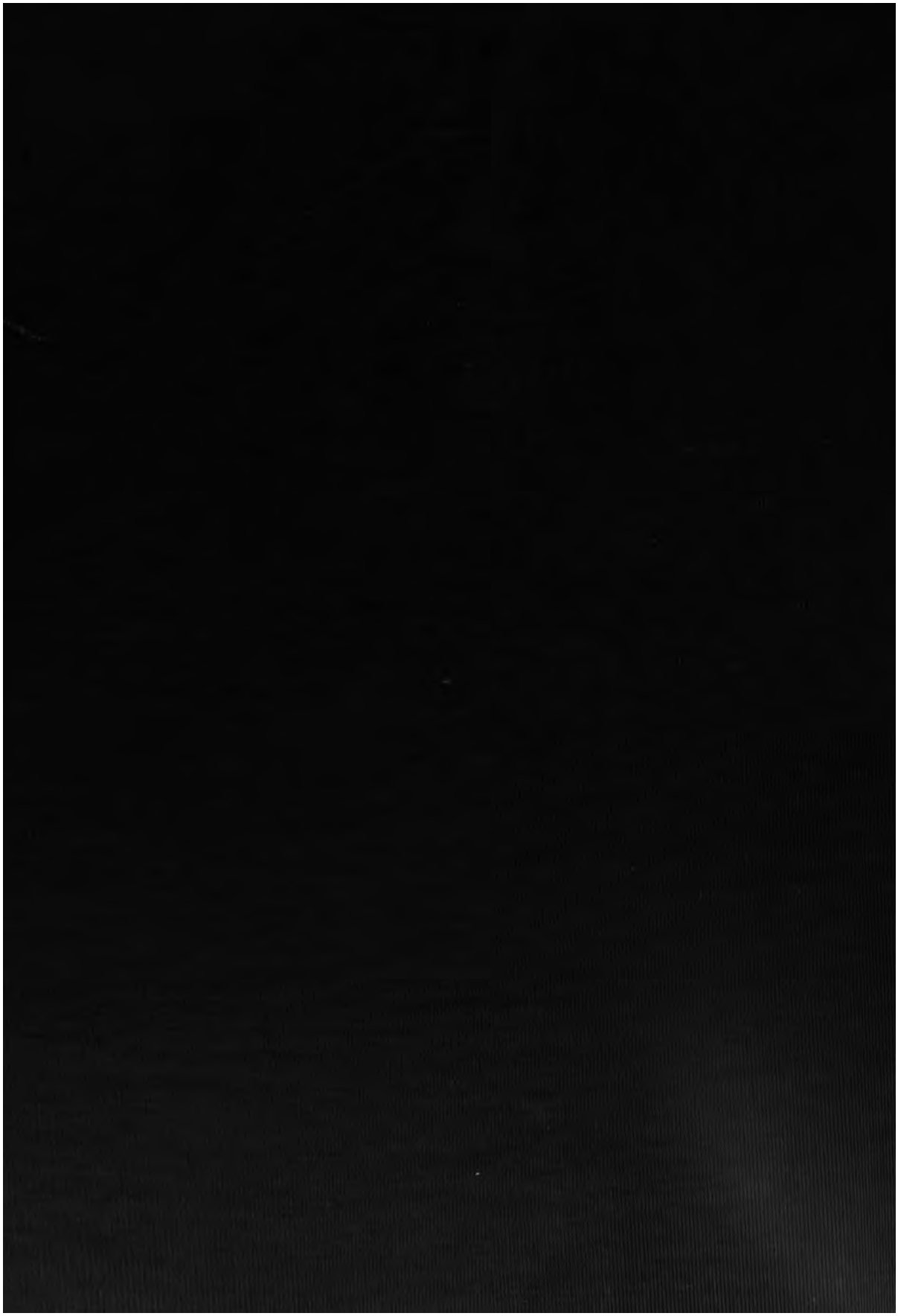
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